EIA REPORT:

Specialist ecological study on the potential impacts of the proposed Oyster Bay Wind Energy Facility Project, Eastern Cape

Prepared by

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on behalf of
RES Southern Africa

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EIA REPORT:

David Hoare Consulting cc
Biodiversity Assessments, Vegetation Description / Mapping, Species Surveys

REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms the EIA Regulations promulgated under the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 385 Section 33 - Specialist reports and reports on specialized processes under the Act. Relevant clauses of the above regulation are quoted below and reflect the required information in the "Control sheet for specialist report" given above.

Regulation 33. (1): An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialized process.

Regulation 33. (2): A specialist report or a report on a specialized process prepared in terms of these Regulations must contain:

(a) details of (i) the person who prepared the report, and
(ii) the expertise of that person to carry out the specialist study or specialized process;

(b) declaration that the person is independent in a form as may be specified by the competent authority;

(c) indication of the scope of, and the purpose for which, the report was prepared;

(d) description of the methodology adopted in preparing the report or carrying out the specialized process;

(e) description of any assumptions made and any uncertainties or gaps in knowledge;

(f) description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;

(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;

(h) description of any consultation process that was undertaken during the course of carrying out the study;

(i) summary and copies of any comments that were received during any consultation process;

(j) any other information requested by the competent authority.

Appointment of specialist

Dr David Hoare of David Hoare Consulting cc was commissioned by Savannah Environmental (Pty) Ltd to provide specialist consulting services for the Environmental Impact Assessment for the proposed Oyster Bay Wind Energy Facility in the Eastern Cape Province. The consulting services comprise an assessment of potential impacts on the flora, fauna, vegetation and ecology in the study area by the proposed project.

Details of specialist

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Summary of expertise

Dr David Hoare:

- PhD in ecology
- Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science, Botanical Science), registration number 400221/05.
- Founded David Hoare Consulting cc, an independent consultancy, in 2001.
- Ecological consultant since 1995.
- Conducted, or co-conducted, over 300 specialist ecological surveys as an ecological consultant.
- Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.
- Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science / ecology at 2 universities and referee for 2 international journals.

Independence

David Hoare Consulting cc and its Directors have no connection with Renewable Energy Systems Southern Africa (Pty) Ltd. David Hoare Consulting cc is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this project is not linked to approval by decision-making authorities responsible for authorising this proposed project and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. David Hoare is an independent consultant to Savannah Environmental (Pty) Ltd and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work. The percentage work received directly or indirectly from the proponent in the last twelve months is 0% of turnover.

Scope and purpose of report

The scope and purpose of the report are reflected in the “Terms of reference” section of this report.

Conditions relating to this report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. David Hoare Consulting cc and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

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INTRODUCTION

Terms of reference and approach

Savannah Environmental (Pty) Ltd. was appointed by Renewable Energy Systems Southern Africa to undertake an application for environmental authorisation through an Environmental Impact Assessment (EIA) for the proposed "Oyster Bay Wind Energy Facility." The project involves the establishment of a wind energy facility and associated infrastructure, including up to 80 wind turbines, an on-site substation, a 132 kV power line linking to Eskom's Melkhout substation, underground cables linking the turbines to the substation, workshop area and internal access roads to each turbine. The purpose of the EIA is to identify environmental impacts associated with the project.

In October 2010 David Hoare Consulting cc was appointed by Savannah Environmental (Pty) Ltd to undertake an ecological assessment of the study area. The specific terms of reference for the ecological EIA study include:

- an indication of the methodology used in determining the significance of potential environmental impacts;
- a description of the environmental issues that were identified during the environmental impact assessment process;
- an assessment of the significance of direct, indirect and cumulative impacts in terms of standard criteria;
- a description and comparative assessment of all alternatives identified during the environmental impact assessment process;
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Plan;
- an indication of the extent to which the issue could be addressed by the adoption of achievable mitigation measures;
- a description of any assumptions, uncertainties and gaps in knowledge;
- an environmental impact statement which contains
- a summary of the key findings of the environmental impact assessment,
- an assessment of the positive and negative implications of the proposed activity,
- a comparative assessment of the positive and negative implications of the distribution line alternatives.

This report provides details of the results of the EIA phase. The findings of the study are based on a desktop assessment of the study area, detailed mapping from aerial imagery and a field survey of the site in addition to expert knowledge of the area gained from general fieldwork conducted in the Eastern Cape over a number of years.

Study area

At a regional level the study area falls within the Eastern Cape Province to the north of the town of Oyster Bay near Humansdorp. A more detailed description of the study area is provided in a section below.

METHODOLOGY

The environmental study is to be undertaken in two phases, a Scoping phase and an Environmental Impact Assessment phase. The objective of the EIA phase study was to assess the significance of potential impacts on flora, fauna and ecology within the study area. This report contains all the descriptive information on flora and fauna that were presented in the Scoping report as well as a comprehensive assessment of potential impacts. The results of the EIA phase study are provided in this report.

Assessment philosophy

Many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. Sites also vary in their natural character and uniqueness and the level to which they have been previously disturbed. Assessing the potential impacts of a proposed development often requires evaluating the conservation value of a site relative to other natural areas and relative to the national importance of the site in terms of biodiversity conservation. A simple approach to evaluating the relative importance of a site includes assessing the following:

- Is the site unique in terms of natural or biodiversity features?
- Is the protection of biodiversity features on site of national/provincial importance?
- Would development of the site lead to contravention of any international, national or provincial legislation, policy, convention or regulation?

Thus, the general approach adopted for this type of study is to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws. Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. These can be organised in a hierarchical fashion, as follows:

Species

1. threatened plant species
2. protected trees
3. threatened animal species

Ecosystems

1. threatened ecosystems
2. protected ecosystems
3. critical biodiversity areas
4. areas of high biodiversity
5. centres of endemism

Processes

1. corridors
2. mega-conservancy networks
3. rivers and wetlands
4. important topographical features

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which are most likely to result in significant negative impacts

on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

1. Environment Conservation Act (Act 73 of 1989)
2. National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998)
3. National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004)

Plant and animal species of concern

The purpose of listing Red Data plant and animal species was to provide information on the potential occurrence of species of special concern in the study area that may be affected by the proposed infrastructure. Species appearing on these lists could then be assessed in terms of their habitat requirements in order to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species of conservation concern previously recorded in the area and any other species with potential conservation value. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute for the quarter degree squares within which the study area is situated.

Regulations published for the National Forests Act provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area.

Lists of threatened animal and bird species that have a geographical range that includes the study area were obtained from literature sources (Alexander & Marais 2007, Barnes 2000, Branch 1988, 2001, du Preez & Carruthers 2009, Friedmann & Daly 2004, Mills & Hes 1997). The likelihood of any of them occurring was evaluated on the basis of habitat preference and habitats available at each of the proposed sites. The three parameters used to assess the probability of occurrence for each species were as follows:

- *Habitat requirements*: most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status*: in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water-quality plays a major role); and
- *Habitat linkage*: movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning Red Data species within the study area.

For all threatened organisms (flora and fauna) that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- MEDIUM: habitats on site match general habitat description for species (e.g. fynbos), but detailed microhabitat requirements (e.g. mountain fynbos on shallow soils overlying

Table Mountain sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. mountain fynbos on shallow soils overlying Table Mountain sandstone);
- DEFINITE: species found in habitats on site.

Vegetation habitats of concern

The purpose of producing a habitat sensitivity map is to provide information on the location of potentially sensitive features in the study area. This was compiled by taking the following into consideration:

1. The general status of the vegetation of the study area was derived by compiling a landcover data layer for the study area (*sensu* Fairbanks et al. 2000) using available satellite imagery and aerial photography. From this it can be seen which areas are transformed versus those that are still in a natural status.
2. Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment (NSBA), Northern Cape Biodiversity Conservation Plan (NCBCP). The mapped results from these were taken into consideration in compiling the habitat sensitivity map.
3. Habitats in which various species of plants or animals occur that may be protected or are considered to have high conservation status are considered to be sensitive.

Assessment of impacts

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase were assessed in terms of the following criteria:

» The **nature**, which includes a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 was assigned as appropriate (with 1 being low and 5 being high):
» The **duration**, wherein it was indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5;
» The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability** *of occurrence*, which describes the likelihood of the impact actually occurring. Probability was estimated on a scale of 1–5, where 1 is very improbable

(probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

» the **significance**, was determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
» the **status**, which was described as either positive, negative or neutral.
» the degree to which the impact can be reversed.
» the degree to which the impact may cause irreplaceable loss of resources.
» the degree to which the impact can be mitigated.

The **significance** was calculated by combining the criteria in the following formula:

S=(E+D+M)P

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Limitations

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of ommitting any species, but it is always possible that a species that does not occur on a list may be unexpectedly located in an area.

Exclusions

The avifaunal assessment is excluded from this study and will be undertaken by a separate specialist.

DESCRIPTION OF STUDY AREA

Location

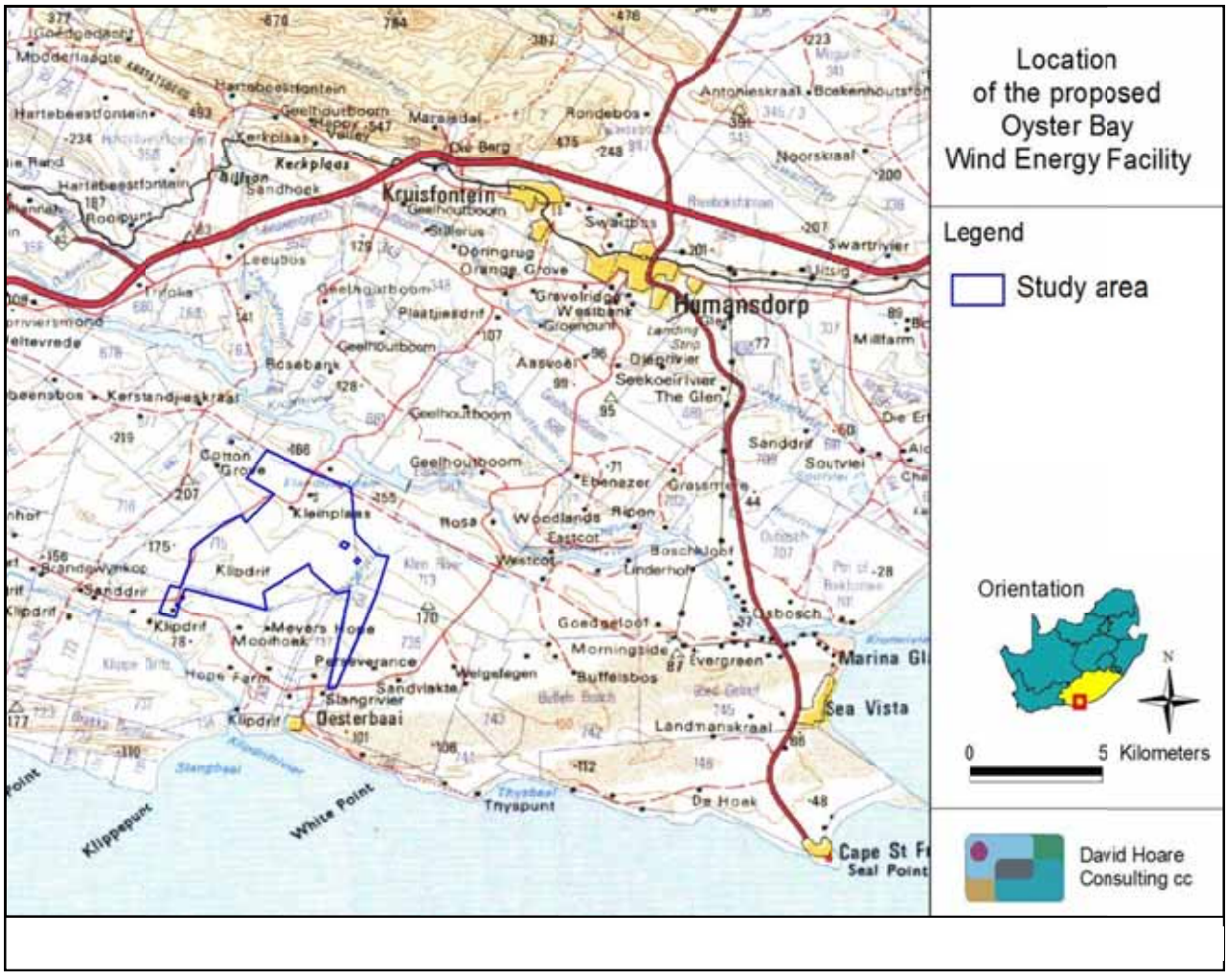
The study site is situated approximately 6 km north of Oyster Bay in the Eastern Cape Province and falls within the quarter degree grid 3424BA (Figure 1). St Francis Bay and Cape St Francis are approximately 14 km to the east-south-east of the site, Humansdorp is approximately 13 km to the north-east of the site and Jeffrey's Bay is approximately 23 km to the east of the site.

The farm portions on which the proposed wind energy facility would occur include the following: Portion 3 of the Farm Klein River 713, Portion 1, 2, 3, 4 and the Remainder of the Farm Rebok Rant 715, Portion 1 and 3 of the Farm Ou Werf 738, Portion 5 of the Farm Klippedrift 732 and Portions 10 and 12 of the Farm Kruis Fontein 681.

No alternative site is currently being considered for the proposed wind energy facility.

The study area is located 9 km to the south of the N2 that links Port Elizabeth to George / Knysna. Access to the site is via the Oyster Bay road from Humansdorp. The site is therefore well-connected to a major route in this region. There is a main road running across the western side of the site from which local access roads lead onto the site. access to site can also be from the west, mainly on gravel / dirt track roads approaching the site

The Melkhout substation is located off site near Humansdorp. This is a minimum of 20 km from the site.



Physiography and soils

The study site is located on the coastal plains south of the Cape Fold mountains in the Humansdorp region. The site is flat to undulating, the plains dissected by relatively shallow river valleys in which perennial or non-perennial streams are usually found. Most of the site is underlain by Table Mountain Group rocks, except in the southern part of the site closest to the coast, where vegetated sand dunes are found.

The study area is moderately sloping. The elevation varies from 30 to 180 m above sea level. The site slopes in general towards the coast, but slopes and topography are locally influenced by the various river valleys.

The site is on the watershed between the Krom and Klipdrif Rivers, both of which flow into the sea relatively close to the site. There are a number of small streams dissecting the landscape. The ones in the northern third of the site drain into the Krom River and the ones in the southern two-thirds of the site drain into the Klipdrif River. The Klipdrif River flows through the southern part of the site.

Detailed soil information is not available for broad areas of the Eastern Cape. As a surrogate, landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). There are two landtypes in the study area, the Ha and Bb landtypes (Land Type Survey Staff, 1987). The Ha land type indicates land types in which deep grey regic sands of the Fernwood form occupy more than 80% of the area. The southern half of the site falls within this land type (MacVicar et al. 1974).

The Bb land type indicates land in which red and/or yellow apedal soils (Hutton, Bainsvlei, Avalon, Glencoe and Pinedene forms) that are dystrophic and/or mesotrophic predominate over red and/or yellow apedal soils that are eutrophic, and in which red soils (mainly Hutton and Bainsvlei) are not widespread (MacVicar et al. 1974). The northern half of the site falls within this land type.

Climate

The study area has warm summers and mild winters. The average daily minima for the coldest months are above freezing. There are, on average, three days of frost per year. The proximity of the coast ameliorates all climate extremes, but the site is in the first range of low mountains inland of the coast and is therefore affected by the proximity of these mountains.

A weak bimodal pattern of rainfall exists in the study area with a slightly higher proportion of spring and autumn rainfall. Rainfall may, however, fall at any time of the year. The mean annual rainfall in the study area is estimated to be approximately 650 mm (Dent *et al*. 1989). In grasslands, all areas with less than 400 mm are considered to be arid grasslands. The study area can therefore be considered to be relatively moist.

Landuse and landcover of the study area

Landcover data for the area (Fairbanks et al. 2000) indicates that large parts of the site have been cultivated. There are, however, areas of remaining natural habitat that require ground-thruthing and further investigation. Google imagery of the site indicates that the landcover map erroneously describes significant areas of rocky shallow soils as cultivated when they are

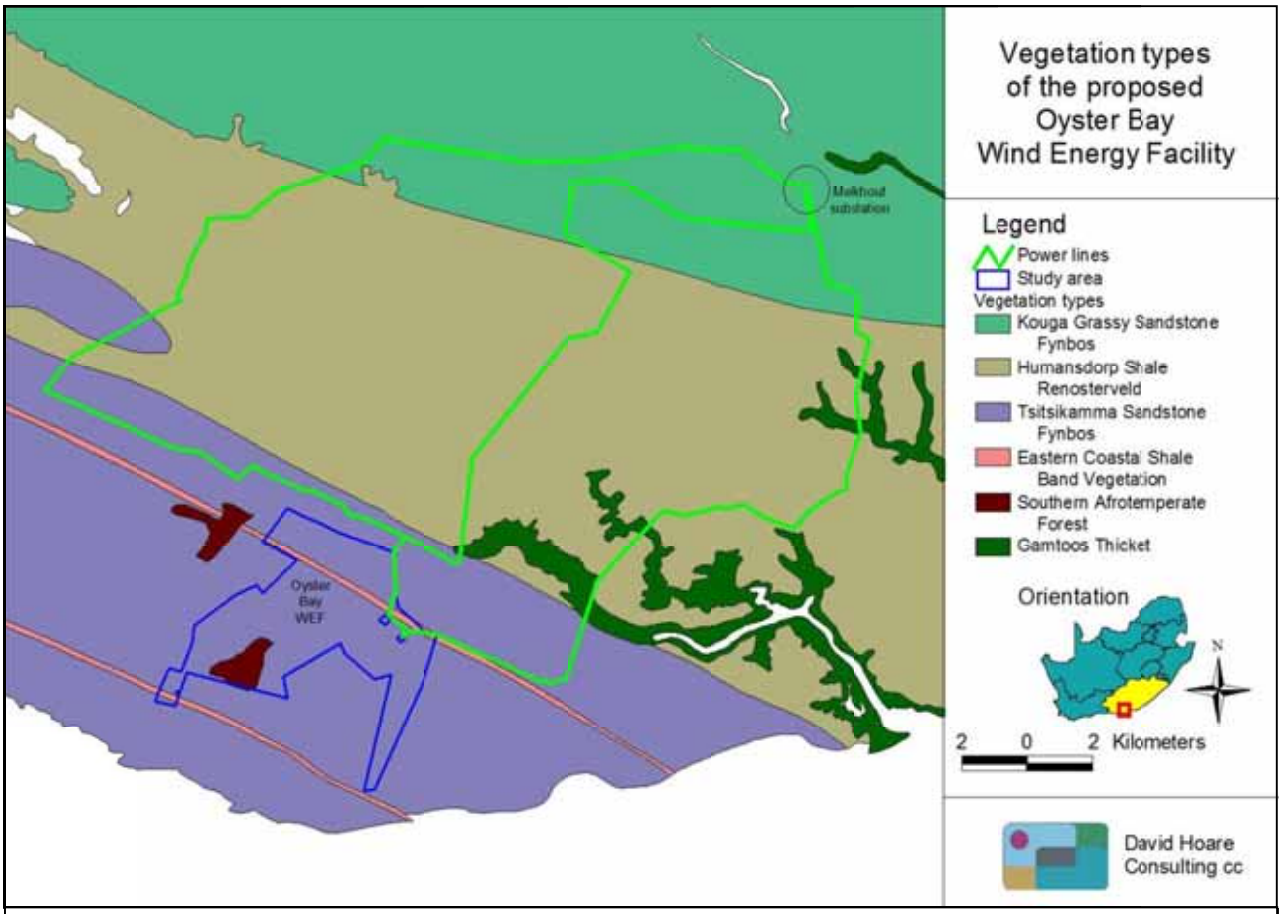
in fact natural. The natural parts of the landscape consist primarily of low grassy fynbos, thicket and woodland. Landcover and vegetation maps (see section below) indicate the presence of a forest patch in the centre of the site, but this appears from aerial imagery to resemble alien trees. It was confirmed in the field that these are alien trees and that no forest occurs in this area.

Cultivated lands are scattered throughout the site.

Broad vegetation types

Vegetation may be described at various hierarchical levels from Biome, to broad Vegetation Type and down to Plant Community level associated with local habitat conditions. There are three general descriptions of the vegetation in the study area. Acocks (1953) published the first comprehensive description of the vegetation of South Africa, which was updated in 1988. This was followed by an attempted improvement (Low & Rebelo 1998) which became widely used due to the inclusion of conservation evaluations for each vegetation type, but is often less rigorous than Acocks's original publication. More recently, a detailed map of the country was produced (Mucina *et al.*, 2005). A companion guide to this map (Mucina & Rutherford 2006), containing up-to-date species information and a comprehensive conservation assessment of all vegetation types, has just been published. The classification of the vegetation according to the most recent publication is given below.

According to this most recent vegetation map of the country the infrastructure could potentially affect a number of different vegetation sites. The site of the wind energy facility



falls primarily within one main vegetation type, i.e. ***Tsitsikamma Sandstone Fynbos***, which falls into the Fynbos Biome. There are also small areas of two other vegetation types apparently occurring on site, namely ***Eastern Coastal Shale Band Vegetation*** and ***Southern Afrotemperate Forest***. The power lines cross three other vegetation types, namely ***Humansdorp Shale Renosterveld***, ***Kouga Grassy Sandstone Fynbos*** and ***Gamtoos Thicket***. South of the site is another vegetation type, ***Southern Cape Dune Fynbos***, but this will not be directly affected by the proposed project.

Tsitsikamma Sandstone Fynbos is found along the Tsitsikamma Mountains from Uniondale to Cape St Francis (Rebelo et al. 2006). This landscape consists of relatively low mountains with gentle to steep slopes. The vegetation type occurs on both the northern and southern slopes of the mountains. It is a medium-dense, tall proteoid shrubland over a dense, moderately tall ericoid-leaved shrubland (Rebelo et al. 2006). This vegetation type occurs throughout the site under assessment (Figure 2).

Eastern Coastal Shale Band Vegetation occurs on the shale bands in the eastern Outeniqua, Langkloof, Tsitsikamma and Kareedouw Mountains and along the southern Cape coastal plains to around Oyster Bay (Rebelo et al. 2006). These shale bands form narrow strips 80 - 200 m wide that are smooth and relatively flat. The vegetation type ranges from thicket to renosterveld and fynbos, including all structural types, although they are often grassy in character (Rebelo et al. 2006). This vegetation type occurs in two narrow bands through the study area (Figure 2), both of which have been transformed by cultivation.

Southern Afrotemperate Forest occurs in Western Cape, Eastern Cape and Northern Cape, with the largest complex in the southern Cape along the narrow coastal strip between Humansdorp in the east and Mossel Bay (Mucina & Geldenhuys 2006). The vegetation type is a tall, multilayered afrotemperate forest dominated by yellowwoods (*Afrocarpus falcatus* and *Podocarpus latifolius*), *Ocotea bullata*, *Olea capensis* subsp. *macrocarpa*, *Pterocelastrus tricuspidatus*, *Platylophus trifoliatus*, *Cunonia capensis*, *Heeria argentea*, *Metrosideros angustifolia*, *Podocarpus elongatus* and *Rapanea melanophloeos* (Mucina & Geldenhuys 2006). This vegetation type is indicated on the vegetation map as occurring as a patch in the central part of the site (Figure 2). This patch is, however, an area of alien vegetation and the vegetation map is incorrect. The other patch to the west/north-west of the site (see Figure 2) is also alien vegetation.

Humansdorp Shale Renosterveld occurs, across its geographic range, in three swathes, one of which extends from Jeffreys Bay near the coast inland past Humansdorp to the lower reaches of the Dieprivier near Two Streams (Rebelo et al. 2006). The vegetation type occurs on moderately undulating plains and undulating hills. It is a vegetation composed of low, medium dense graminoid, dense cuppressoid-leaved shrubland, dominated by renosterbos (Rebelo et al. 2006). There are both grassland shrubland and grassland forms of the renosterveld. Thicket patches are common on termitaria and fire-safe enclaves. This vegetation type occurs as a small sliver in the central areas across which the power lines are proposed to traverse.

Kouga Grassy Sandstone Fynbos is found in the Western and Eastern Cape from Uniondale to Uitenhage, including the low mountains and flats north of Humansdorp (Rebelo et al. 2006). It is a low shrubland vegetation with sparse, emergent tall shrubs and dominated by grasses in the undergrowth, or grassland with scattered ericoid shrubs (Rebelo et al. 2006). It is found in the northern parts of the region under study, close to the mountains, and includes the Melkhout substation (Figure 2).

Gamtoos Thicket occurs in the Eastern Cape in the coastal basin of the Gamtoos River valley, south of the Baviaanskloof Mountains and along some smaller river valleys (Hoare et al. 2006). It occurs on low mountain slopes in steeply sloping areas and on low ridges (Hoare et al. 2006). It is a tall dense thicket, where both the trees and shrubs and the succulent component are well represented (Hoare et al. 2006). Few distinct strata can be differentiated within this vegetation, with upper and lower canopy species intertwined (Hoare et al. 2006).

Southern Cape Dune Fynbos occurs in the Western and Eastern Cape from Wilderness and Buffels Bay near Knysna to Oyster Bay (Rebelo et al. 2006). The vegetation type occurs on the coastal dune cordons, often with steep slopes. It is a fynbos heath vegetation dominated by sclerophyllous shrubs with a rich restio undergrowth (Rebelo et al. 2006). This vegetation type occurs to the south of the site (Figure 2) and will not be affected by the proposal.

Table 1: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Conservation status of broad vegetation types

The vegetation types of South Africa have been categorised according to their conservation status which is, in turn, assessed according to degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in Table 1, as determined by best available scientific approaches (Driver et al. 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

Tsitsikamma Sandstone Fynbos is classified in Mucina *et al*. (2006) as Vulnerable, with 40% conserved of a target of 23% and 33% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), does not list this vegetation type in any conservation category.

Eastern Coastal Shale Band Vegetation occurs is classified in Mucina *et al*. (2006) as Endangered, with 16% conserved of a target of 27% and 64% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists this vegetation type as Vulnerable.

Southern Afrotemperate Forest is classified in Mucina *et al*. (2006) as Least Threatened, with 60% conserved of a target of 34% and 3% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), does not list this vegetation type in any conservation category, but forest patches are protected under the National Forest Act (Act No. 84 of 1998). There are, however, no forest patches on site (see section above).

Humansdorp Shale Renosterveld is classified in Mucina *et al*. (2006) as Endangered, with none conserved of a target of 29% and 61% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists this vegetation type as Endangered.

Kouga Grassy Sandstone Fynbosis classified in Mucina *et al*. (2006) as Least Threatened, with 19% conserved of a target of 23% and 9% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), does not list this vegetation type in any conservation category.

Gamtoos Thicketis classified in Mucina *et al*. (2006) as Least Threatened, with 6% conserved of a target of 19% and 14% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), does not list this vegetation type in any conservation category.

Southern Cape Dune Fynbos is classified in Mucina *et al*. (2006) as Least Threatened, with 16% conserved of a target of 36% and 17% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), does not list this vegetation type in any conservation category.

Table 2: Conservation status of different vegetation types occurring in the study area, according to Driver *et al*. 2005 and Mucina *et al*. 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver *et al*. 2005; Mucina *et al*., 2006	Draft Ecosystem List (NEMBA)
Tsitsikamma Sandstone Fynbos	23	40	33	Vulnerable	Not listed
Eastern Coastal Shale Band Vegetation	27	16	64	Endangered	Vulnerable
Southern Afrotemperate Forest	34	60	3	Least Threatened	Not listed
Humansdorp Shale Renosterveld	29	0	61	Endangered	Endangered
Kouga Grassy Sandstone Fynbos	23	19	9	Least threatened	Not listed
Gamtoos Thicket	19	6	14	Least threatened	Not listed
Southern Cape Dune Fynbos	36	16	17	Least Threatened	Not listed

The Cape Floristic Region

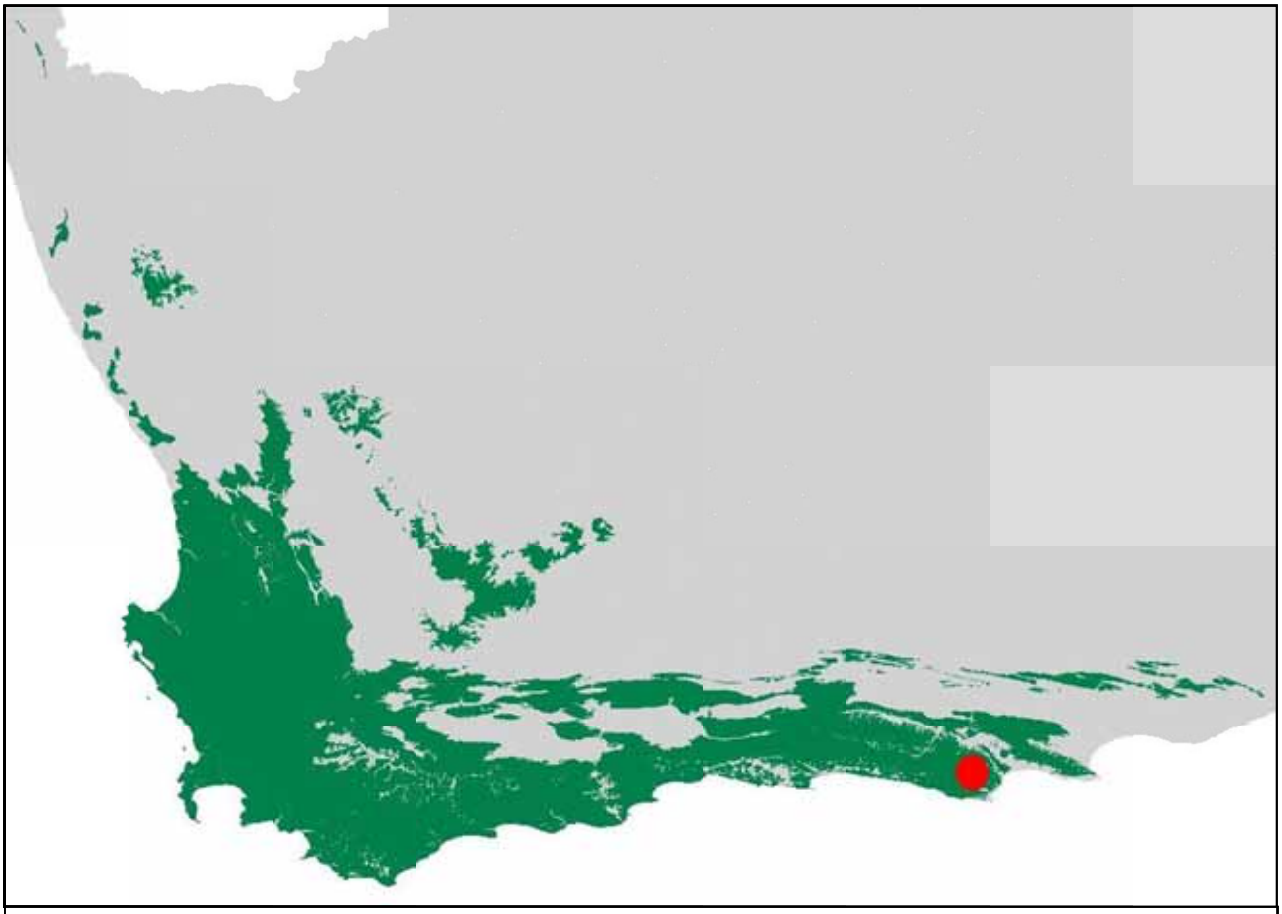
The study area occurs within the Cape Floristic Region (see Figure 3), which is recognised as one of the principal centres of diversity and endemism in Africa (van Wyk & Smith 2001). Moreover, it is one of the earth's 25 hotspots, i.e. geographical areas that contain the world's greatest plant and animal diversity while also being subjected to high levels of pressure from development and/or degradation (Mittermeier *et al*. 2000). The Cape Floristic region is also the only hotspot that encompasses an entire Floristic Kingdom. This region has the greatest

extratropical concentration of plant species in the world, with 9000 plant species, 6210 of which are endemics (Cowling & Pierce 2000). Diversity and endemism are high at the generic and familial level as well, with five of South Africa's 12 endemic plant families.

The characteristic and most widespread vegetation of the Cape Floristic Region (CFR) is fynbos, consisting of hard-leaved, evergreen, fire-prone shrubs. Other vegetation types occurring in the CFR are Renosterveld, Succulent Karoo, Subtropical Thicket and Afromontane forest, although only Fynbos and Renosterveld are considered to be the main vegetation types in the CFR. Fynbos is associated with the nutrient poor soils of the Cape fold Belt mountains. It is very species rich, with over 75% of the CFR species associated with it, including all the endemic families and most of the endemic genera (van Wyk & Smith 2001). The vegetation type is characterized by a preponderance of Restionaceae, Ericaceae and Proteaceae and a paucity of annuals and grasses. Fynbos is rich in geophytes, notably from the families Liliaceae, Iridaceae and Orchidaceae, and is thought to harbour the richest geophyte flora in the world (Cowling & Richardson 1995). Many different types of Fynbos vegetation are recognised: a total of 78 fynbos and 38 renosterveld vegetation types have been mapped in the recently compiled vegetation map of South Africa (Mucina, Rutherford & Powrie 2005) of a total of 435 vegetation types of the whole country (more than a quarter of the total).

The Fynbos Biome and the CFR are largely concurrent and also match the boundaries of the two main vegetation types found in the Fynbos Biome, fynbos and renosterveld.

Permanent and complete transformation of habitat has affected 33% of the CFR hotspot, which includes the Oyster Bay site. Less than 20% of the total area covered by the CFR hotspot can be considered close to the pristine state in the sense that it is entirely free of alien plants and subjected to appropriate fire and grazing regimes (Cowling & Pierce 2000). The



study area is within this hotspot area near its eastern end (see Figure 3) and, although the hotspot contains a wide variety of vegetation types, the study area contains a number of vegetation types that are typical of the areas of concern within the hotspot.

Red List plant species of the study area

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1. Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed.

The species on this list were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration, there were ten species recorded in the quarter degree grid in which the study area is located that are listed on the Red List that could occur in habitats that are available in the study area. According to IUCN Ver. 3.1 (IUCN, 2001) two of these are listed as Endangered, six as Vulnerableand two as Near Threatened (see Table 3 for explanation of categories). All except two of these species are highly likely to occur on site; the site is at the locality where the species have been previously recorded or the species have been recorded just adjacent to the site in similar habitats.

Table 3: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Data Deficient
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient
LC	Least Concern	Least Concern

Red List animal species of the study area

All Red List vertebrates (mammals, reptiles, amphibians, fish) that could occur in the study area are listed in Appendix 2. Those vertebrate species with a geographical distribution that includes the study area and habitat preference that includes habitats available in the study area are discussed further.

There are a number of mammal species of conservation concern that have a distribution that coincides with the study area. Only four of these are considered to have a possibility of occurring on site as a result of habitats available, i.e. the Brown Hyaena, the Fynbos golden

mole and the Natal Long-fingered Bat, all listed as Near Threatened[1], and Duthie's Golden Mole, listed as vulnerable.

There are two reptile and no amphibian species of conservation concern that have a distribution that includes the study area and which could occur on site. The two reptile species are the Spotted Rock Snake (Rare) and the Yellow-bellied House Snake (Near Threatened). There are therefore no threatened (CR, EN or VU) reptile or amphibian species that are likely to occur on site (see Table 3 for explanation of conservation categories).

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. Those that have a geographical distribution that includes the study area are *Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme* subsp. *inerme*.

Ocotea bullata occurs in montane forest. *Pittosporum viridiflorum* occurs along forest margins, in bush-clumps and in bushveld, often in rocky outcrops. *Podocarpus falcatus* is found in Afromontane forest. *Podocarpus latifolius* is found in coastal and Afromontane forest. *Sideroxylon inerme* subsp. *inerme* usually only occurs in coastal areas, in dune thicket and forest, but may also occur on termitaria in bushveld.

Based on habitat preferences, any of these species could occur on or near the site. *Sideroxylon inerme* subsp. *inerme*, *Pittosporum viridiflorum*, *Podocarpus falcatus* and *Podocarpus latifolius* have been previously recorded in the grid in which the study site is located, as well as surrounding grids (see Appendix 4). If any of these species occur in the study area, the most likely places would be in the thicket in the drainage lines or in woodland or forest patches. High concentrations were found in valleys and scattered individuals in more open areas, especially as stunted individuals within rocks on small rocky outcrops or in areas with high general rock cover.

Other features of conservation concern

There have been a number of regional conservation assessments produced within the Eastern Cape Province, including the following:

- Subtropical Thicket Ecosystem Programme (STEP)
- Succulent Karoo Ecosystems Programme (SKEP)
- National Spatial Biodiversity Assessment (NSBA)
- Eastern Cape Biodiversity Conservation Plan (ECBCP).

These studies identify patterns and processes that are important for maintaining biodiversity in the region. Unfortunately, many of these studies have been done using coarse scale satellite imagery that does not provide spatial or spectral accuracy at the scale of the present study. They are, however, useful for understanding broad issues and patterns within the area. The ECBCP has integrated all previous studies and is a useful reference for identifying conservation issues in the study area and surrounds.

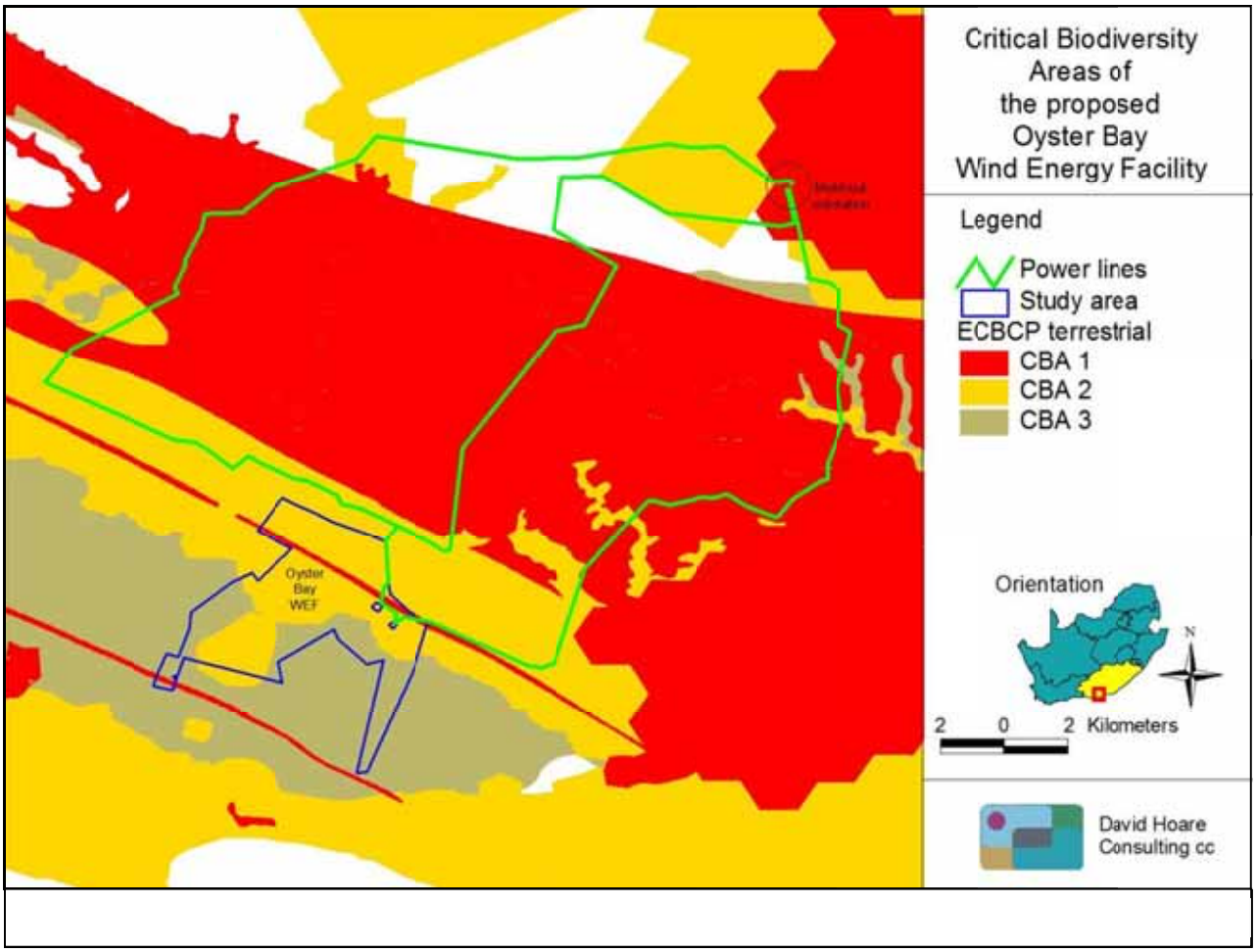
[1] Note that there are a number of species previously listed in a threatened category that, according to the IUCN, are now listed as Least Concern (see Appendix 2).

The ECBCP identifies Critical Biodiversity Areas (CBAs), which are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning (Berliner & Desmet 2007). The ECBCP identifies CBAs at different levels with decreasing biodiversity importance, as follows:

1. PA: Protected areas.
2. CBA 1: CR vegetation types and irreplaceable biodiversity areas (areas definitely required to meet conservation targets).
3. CBA 2: EN vegetation types, ecological corridors, forest patches that do not fall into CBA 1, 1 km coastal buffer, irreplaceable biodiversity areas that do not fall into CBA 1.
4. CBA 3: VU vegetation types.

Within and around the study area, the ECBCP identifies CBAs at three levels that occur within the study area and surroundings (Figure 4). It must be noted that this is a broad-scale map and does not necessarily represent local-scale patterns accurately. Areas where vegetation has been transformed to cultivation, alien trees or other factors may be represented as being within a particular CBA, whereas they are in fact, not sensitive.

The CBA 1 areas that fall within the study site are vegetation types of high conservation value, in this case Eastern Coastal Shale Band vegetation and Humansdorp Shale Renosterveld vegetation, both classified as Endangered. Note that Eastern Coastal Shale Band Vegetation no longer occurs in any intact form on site. The CBA 2 areas that fall within the study site are corridor areas, the forest patch (which has been identified as being alien vegetation) and vegetation identified in the STEP project as being important (Southern Cape Dune Fynbos).



The corridor areas are important for a number of reasons, including the maintenance of ecological processes. The CBA 3 areas that fall within the study site are vegetation types of conservation importance (in this case Tsitsikamma Sandstone Fynbos). Despite the Oyster Bay site falling into these CBAs the vegetation is largely transformed due to cattle and sheep farming. Only remaining patches of natural vegetation are sensitive, not all areas that are transformed as well.

Sensitivity assessment

The sensitivity assessment identifies those parts of the study area that could (a) possibly have high conservation value or that (b) may be sensitive to disturbance. Areas of potentially high sensitivity are shown in Figure 5. An explanation of the different sensitivity classes is given in Table 4. Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity. The information provided in the preceding sections was used to compile a map of remaining natural habitats and areas important for maintaining ecological processes in the study area. Relatively fine-scale mapping was used to provide information on the location of sensitive features.

Table 4: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
VERY HIGH	Indigenous natural areas that are highly positive for any of the following: • presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. • High conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • Protected habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act) And may also be positive for the following: • High intrinsic biodiversity value (high species richness and/or turnover, unique ecosystems) • High value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) • Low ability to respond to disturbance (low resilience, dominant species very old).	• CBA 1 areas. • Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable. • Protected forest patches. • Confirmed presence of populations of threatened species.
HIGH	Indigenous natural areas that are positive for any of the following: • High intrinsic biodiversity value (moderate/high species richness and/or turnover). • presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species). • Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age). • Moderate conservation status (moderate proportion remaining intact, moderately	• CBA 2 “critical biodiversity areas”. • Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records). • Confirmed habitat for species of lower threat status (near threatened, rare). • Habitat containing

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
	fragmented, habitat for species that are at risk). • Moderate to high value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). And may also be positive for the following: • Protected habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)	individuals of extreme age. • Habitat with low ability to recover from disturbance. • Habitat with exceptionally high diversity (richness or turnover). • Habitat with unique species composition and narrow distribution. • Ecosystem providing high value ecosystem goods and services.
MEDIUM-HIGH	Indigenous natural areas that are positive for one or two of the factors listed above, but not a combination of factors.	• CBA 2 "corridor areas". • Habitat with high diversity (richness or turnover). • Habitat where a species of lower threat status (e.g. (near threatened, rare) could potentially occur (habitat is suitable, but no confirmed records).
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.	
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.	
LOW	No natural habitat remaining.	

Any natural vegetation within which there are features of conservation concern will be classified into one of the high sensitivity classes (MEDIUM-HIGH, HIGH or VERY HIGH. The difference between these three high classes is based on a combination of factors and can be summarised as follows:

1. Areas classified into the VERY HIGH class are vital for the survival of species or ecosystems. They are either known sites for threatened species or are ecosystems that have been identified as being remaining areas of vegetation of critical conservation importance. CBA1 areas would qualify for inclusion into this class.
2. Areas classified into the HIGH class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH class, but a site where a threatened species could potentially occur

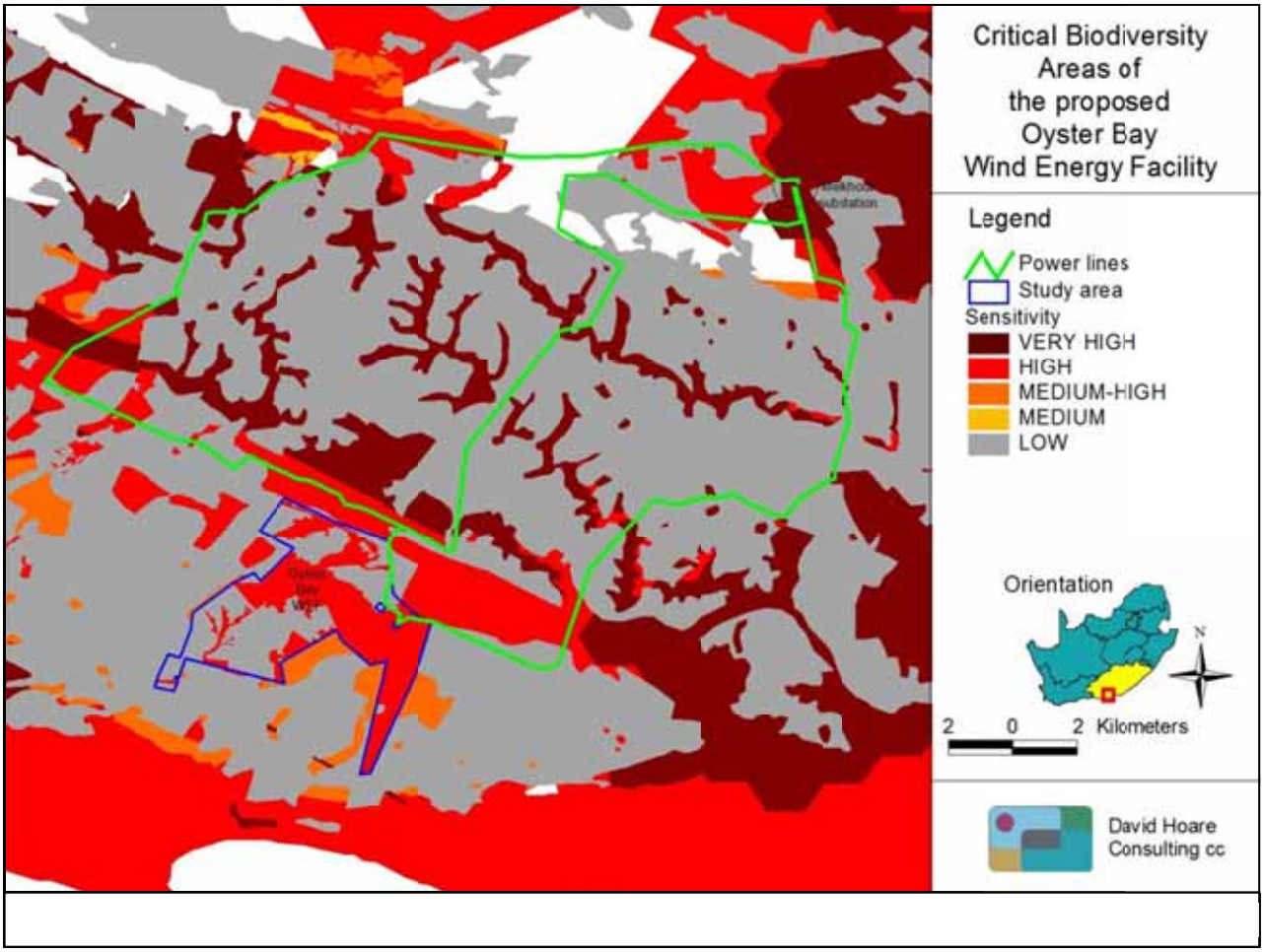
(habitat is suitable), but it is not known whether it does occur there or not, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status, but have high local species richness, unique species composition, low resilience or provide very important ecosystem goods and services. CBA2 "irreplaceable biodiversity areas" would qualify for inclusion into this class, if there were no other factors that would put them into the highest class.

3. Areas classified into the MEDIUM-HIGH sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent that they would be classified into one of the other two higher categories. CBA2 "corridor areas" would qualify for inclusion into this class.

There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

1. vegetation of conservation importance: this is based primarily on the ECBCP assessment (see Figure 4), the Draft Ecosystem List and the fact that the site falls within the Cape Floristic Region;
2. perennial and non-perennial rivers and streams and wetlands: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;
3. potential occurrence of populations of Red List organisms, including flora and fauna that have been evaluated as having a high chance of occurring within remaining natural habitats within the study area.

These factors have all been taken into account in mapping potentially sensitive areas within



the study area. These are mapped in Figure 5. The sensitivity classification for the site is as follows:

1. HIGH: (i) All of the drainage lines on site are classified as having high sensitivity (see Table 4 and Figure 5). They are protected according to the National Water Act (Act 36 of 1998). Ecologically, they are areas that provide high value ecosystem goods and services. (ii) Also classified as having high sensitivity are all areas of fynbos on site. These are potential habitat for the Endangered plant species, *Disa lugens* var. *lugens*, the Vulnerable plant species, *Bobartia macrocarpa*, and the Near threatened plant species, *Pauridia minuta*. They are also considered to have high intrinsic biodiversity value, including high species richness, high habitat variability and high probability of containing species of narrow distribution and/or ecological amplitude.
2. LOW: Areas where no natural vegetation occurs is classified as having low sensitivity (see Table 4 and Figure 5). This includes cultivated lands, previously cultivated areas with secondary vegetation, areas dominated by alien trees, and areas of buildings, roads and bare ground.

Only a course-scaled sensitivity classification is provided for the power lines (areas not within the proposed site of the wind energy facility). A detailed map would require mapping of landcover across a wide area, which is beyond the scope of this study. As an indication of sensitivity, remaining natural areas are categorised according to the ECBCP. An existing landcover map was used to identify remaining natural areas. This is not particularly accurate at a site scale, but provides a general assessment of the location of sensitive areas and the degree of sensitivity.

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

Relevant legislation is provided in this section to provide a description of the key legal considerations of importance to the proposed project. The applicable legislation is listed below.

Legislation

National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA requires, inter alia, that:

- "development must be socially, environmentally, and economically sustainable",
- "disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied." ,
- "a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions",

NEMA states that "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."

Environment Conservation Act No 73 of 1989 Amendment Notice No R1183 of 1997

The ECA states that:

Development must be environmentally, socially and economically sustainable. Sustainable development requires the consideration of inter alia the following factors:

- that pollution and degradation of the environment is avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and
- that negative impacts on the environment and on peoples' environmental rights be anticipated and prevented, and where they cannot be altogether prevented are minimised and remedied.

The developer is required to undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations in order to control activities which might have a detrimental effect on the environment. Such activities will only be permitted with written authorisation from a competent authority.

National Forests Act (Act no 84 of 1998)

Protected trees

According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ' no person may cut, damage, disturb, destroy or remove any *protected tree*, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.

Forests

Prohibits the destruction of indigenous trees in any natural forest without a licence.

National Environmental Management: Biodiversity Act (Act No 10 of 2004)

In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).

- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.

Integrated Coastal Zone Management Act (Act No. 24 of 2008)

The purpose of the Act is to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and economically sustainable; to define rights and duties in relation to coastal areas; to determine the responsibilities of organs of state in relation to coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; to give effect to South Africa's international obligation in relation to coastal matters; and to provide for matters connected therewith. The Act provides for integrated management of the coastal zone and contains a number of Chapters dealing with various components. Those that may affect the current project are as follows:

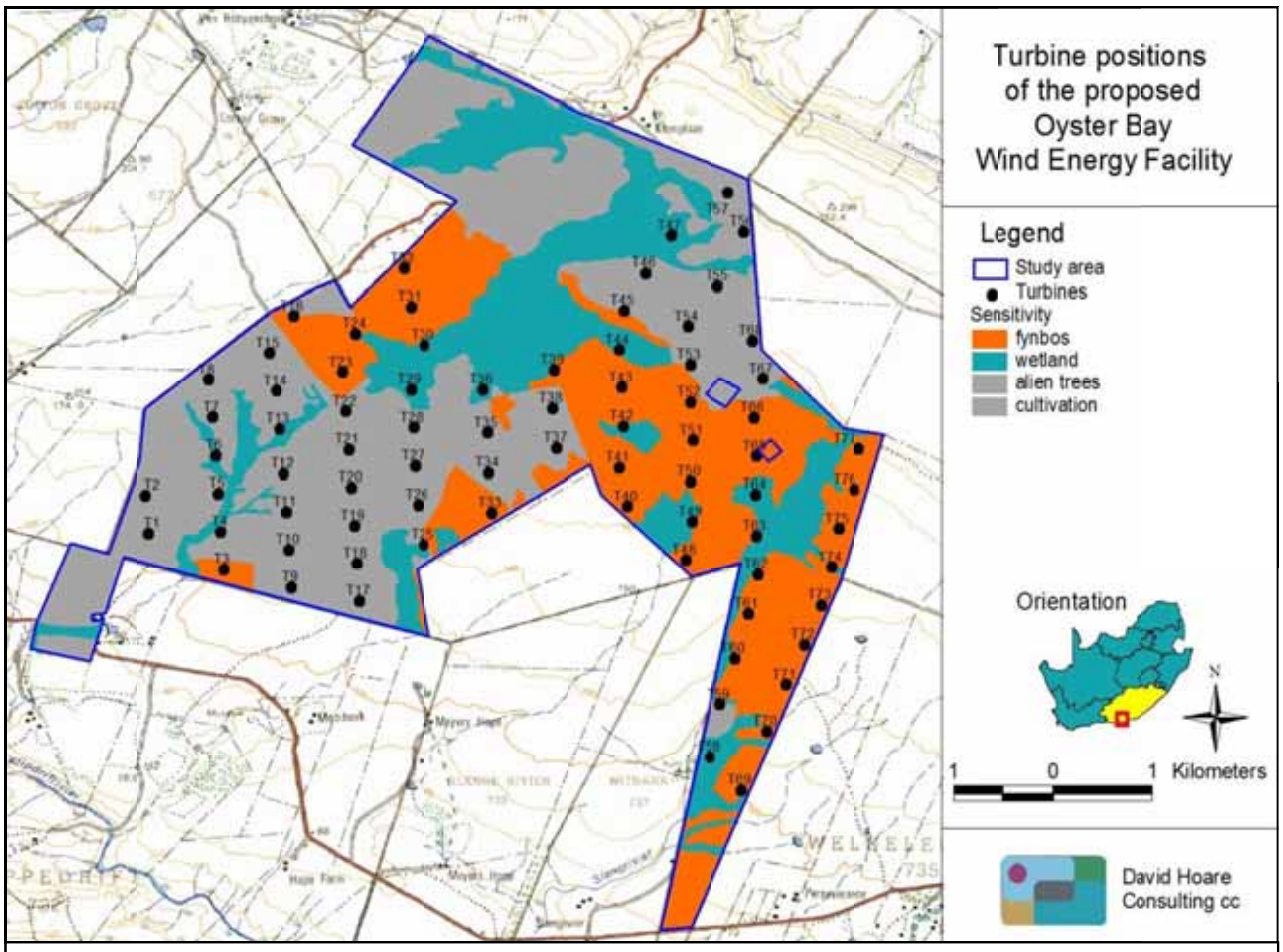
- A coastal protection zone is defined in which development is restricted or controlled. A relatively arbitrary distance of 1000 m is defined in the act as constituting this coastal protection zone, but sections of the act (sections 26 to 29) set out procedures whereby the various coastal areas may be specifically demarcated on a case-by-case basis.
- Assessing the environmental impact of activities which may detrimentally affect the coastal zone will be done in terms of the general environmental impact assessment regulations which were promulgated in terms of Chapter 5 of NEMA. Section 63 of Act 24 of 2008 provides the factors and criteria which the competent authority must consider when issuing environmental authorisations for activities affecting the coastal zone.

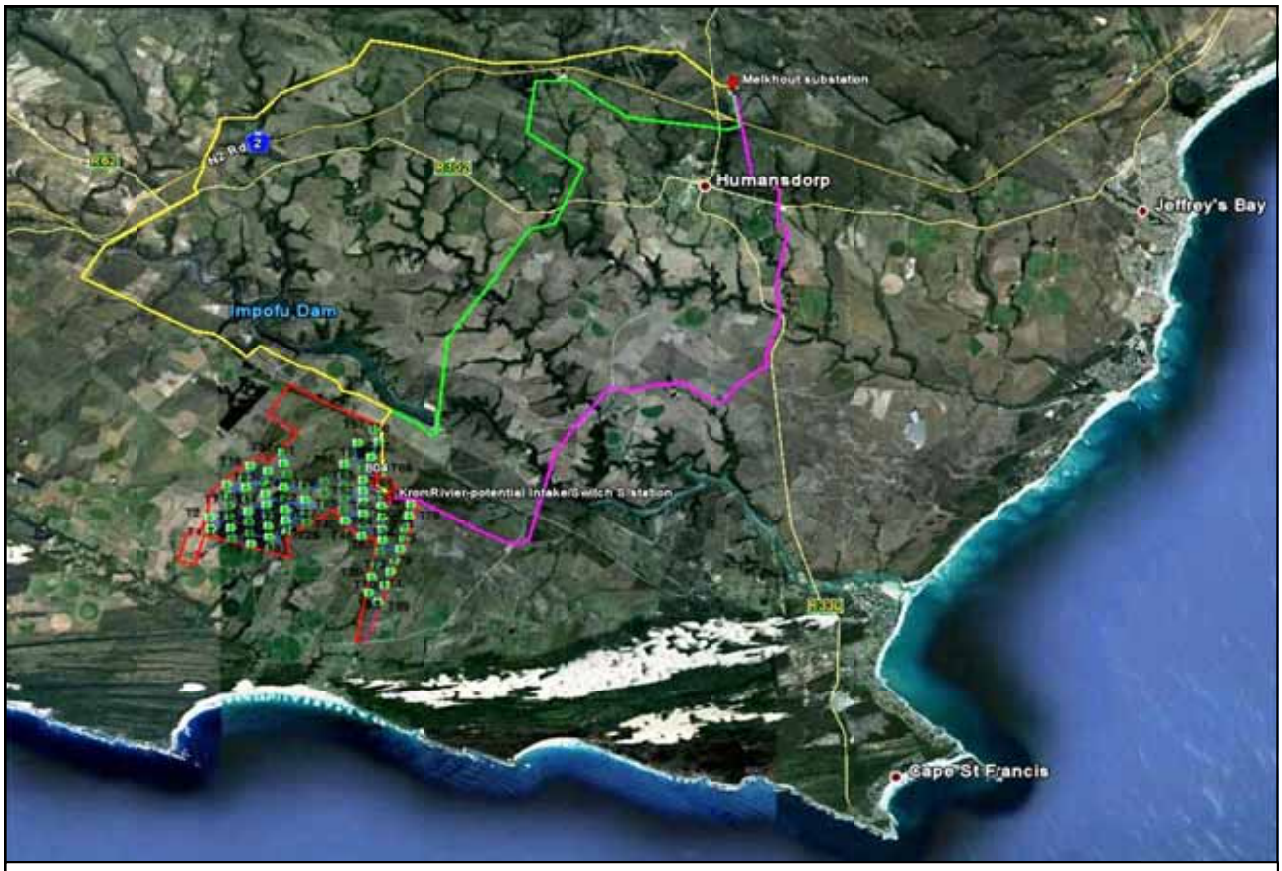
DESCRIPTION OF INFRASTRUCTURE

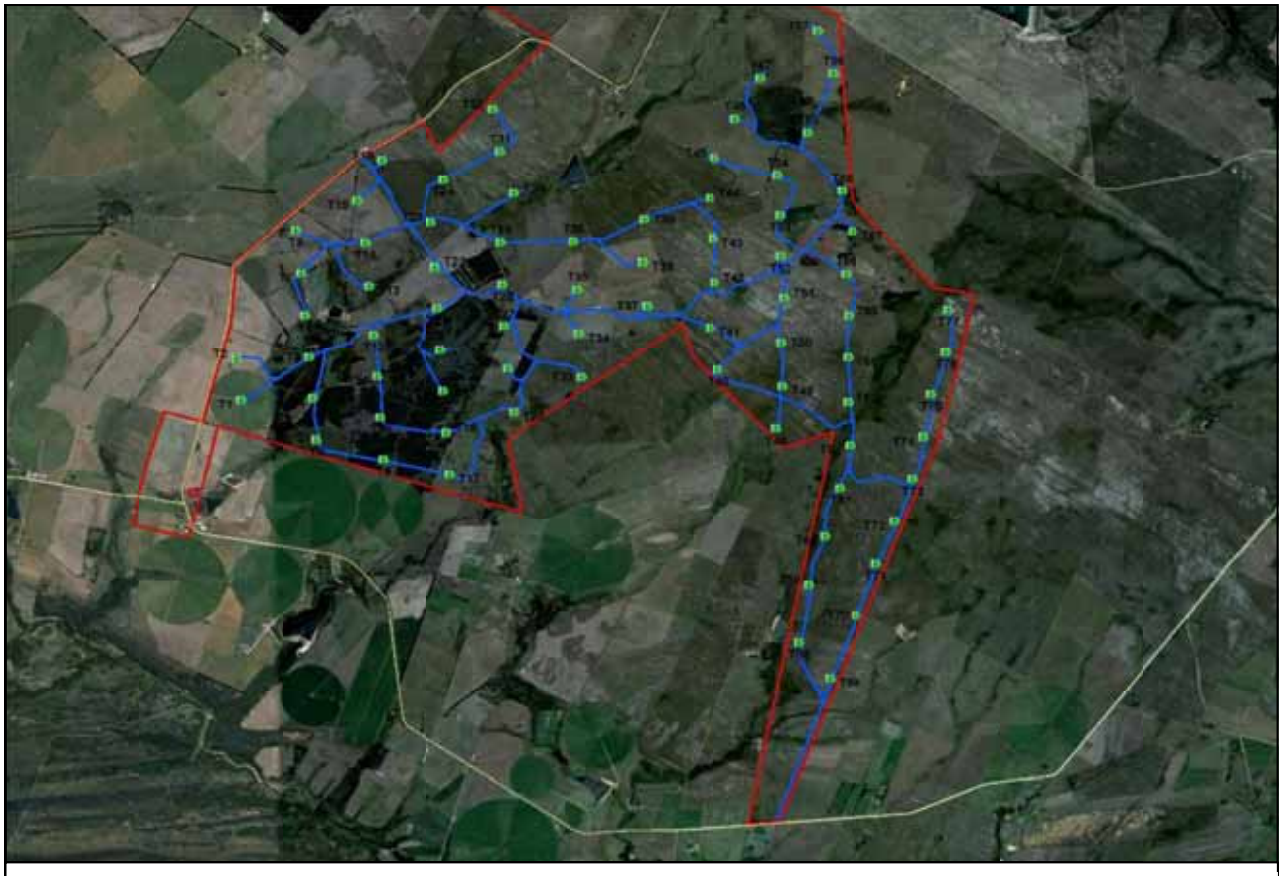
The position of the proposed infrastructure within the study area is indicated in Figure 6. This shows 77 turbines. These will be linked by a network of internal access roads (not shown in Figure 6), which is also the planned position of the underground cables linking the turbines to one another and to the substation.

There are two alternative positions for the substation. These are shown as the small blue squares in Figure 6.

There are three alternative power line alignments from the site to the Melkhout substation, which is located just to the north of Humansdorp. These are shown in Figure 7 (western option in yellow, central option in green and eastern option in purple).




Melkhout substation
Humansdorp
Jeffrey's Bay
Impofu Dam
KromRivier-potential Intake/Switch Station
Cape St Francis



IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS

Potential issues relevant to potential impacts on the ecology of the study area include the following:

- Impacts on biodiversity: this includes any impacts on populations of individual species of concern (flora and fauna), including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of concern.
- Impacts on sensitive habitats: this includes impacts on any sensitive or protected habitats, including, for example, indigenous forest, thicket and wetland vegetation, that leads to direct or indirect loss of such habitat.
- Impacts on ecosystem function: this includes impacts on any processes or factors that maintain ecosystem health and character, including the following:
    - disruption to nutrient-flow dynamics;
    - impedance of movement of material or water;
    - habitat fragmentation;
    - changes to abiotic environmental conditions;
    - changes to disturbance regimes, e.g. increased or decreased incidence of fire;
    - changes to successional processes;
    - effects on pollinators;
    - increased invasion by alien plants.

  Changes to factors such as these may lead to a reduction in the resilience of plant communities and ecosystems or loss or change in ecosystem function.
- Secondary and cumulative impacts on ecology: this includes an assessment of the impacts of the proposed project taken in combination with the impacts of other known projects for the area or secondary impacts that may arise from changes in the social, economic or ecological environment.
- Impacts on the economic use of vegetation: this includes any impacts that affect the productivity or function of ecosystems in such a way as to reduce the economic value to users, e.g. reduction in grazing capacity, loss of harvestable products. It is a general consideration of the impact of a project on the supply of so-called ecosystem goods and services.

A number of direct risks to ecosystems would result from construction of the proposed WEF, as follows:

- Clearing of land for construction.
- Construction of access roads.
- Establishment of borrow and spoil areas.
- Chemical contamination of the soil by construction vehicles and machinery.
- Operation of construction camps.
- Storage of materials required for construction.

Description of potential impacts

Major potential impacts are described briefly below. These are compiled from a generic list of possible impacts derived from previous projects of this nature and from a literature review of the potential impacts of wind energy facilities on the ecological environment. There are two major ways that wind-energy development may influence ecosystem structure and functioning—through direct impacts on individual organisms and through impacts on habitat structure and functioning. The most important potential negative ecological impacts of a WEF

are related to bird and bat mortality and loss of habitat. The most important positive environmental impact of a WEF is related to decreased dependency on coal power. Potential impacts are discussed in more detail below:

Impact 1: Impacts on bats

Nature: Bird and bat deaths are one of the most controversial biological issues related to wind turbines. The deaths of birds and bats at wind farm sites have raised concerns by conservation agencies internationally. In order to address this issue in South Africa, the Endangered Wildlife Trust (EWT) and BirdLife South Africa (BLSA) have combined efforts to lobby for the appropriate consideration of the potential negative effects of wind energy production.

Bats have been found to be particularly vulnerable to being killed by wind turbines. It has long been a mystery why they should be so badly affected since bat echo-location allows them to detect moving objects very well. A recent study in America has found that the primary cause for mortality is a combination of direct strikes and barotrauma (bats are killed when suddenly passing through a low air pressure region surrounding the turbine blade tips causing low pressure damage to the bat's lungs, Baerwald *et al*. 2008). The relative importance of this impact on bat populations depends on which species are likely to be affected, the importance of the site for those species and whether the site is within a migration corridor for particular bat species.

The most vulnerable species are those that are already classified as threatened species, including those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species unless the impact occurs across a wide area that co-incides with their overall distribution range. Loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

It has been evaluated that there is one Near Threatened bat species that could occur site or in the surrounding areas, i.e. the Natal Long-fingered Bat. This species is most likely to be affected by the operation of the WEF to a greater extent than the construction of the WEF.

Impact 2: Impacts on other threatened animals

Nature: Threatened animal species are affected primarily by the overall loss of habitat, since direct construction impacts can often be avoided due to movement of individuals from the path of construction.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localized populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival chances.

It has been evaluated that there are three mammal species of conservation concern that could potentially be affected by the proposed wind energy facility, i.e. the Brown Hyaena and the Fynbos Golden Mole, listed as Near Threatened, and Duthie's Golden Mole, listed as Vulnerable. In addition, there is one near threatened reptile species that has a distribution that includes the study area and which could occur on site, i.e. the Yellow-bellied House Snake.

The Brown Hyaena is a mobile animal that is likely to avoid the site during construction and re-appear afterwards. This species is therefore unlikely to be affected by construction or operation of the proposed infrastructure.

The two mole species are not mobile and, if they occur on site, are likely to be affected by the construction of infrastructure since they are largely unable to move away during construction and are dependent on habitat remaining intact. The Fynbos Golden Mole is found in lowland fynbos and Knysna forest, also in urban areas. It prefers sandy soils with a deep litter layer. The dune area south of the site is probable habitat for this species, but it could also occur within areas of sandy soil on site. Duthie's Golden Mole occurs in alluvial sand and sandy loam. The dune area south of the site is probable habitat for this species as well, although, once again, this species could also occur within areas of sandy soil on site. The threatened status of this species (classified as vulnerable) and the narrow distribution of the species indicates that impacts on any populations could have a significant negative impact on the overall conservation status of the species.

The Yellow-bellied House Snake is unlikely to be able to move away during the construction phase, or is dependent on habitats on site remaining intact. This species, although listed as Near Threatened, occurs throughout a wide part of South Africa and the overall status of the species is very unlikely to be significantly affected by the complete loss of the site, which constitutes a very small fraction of its potential overall range. This species as a whole is therefore unlikely to be affected by construction of the proposed infrastructure.

Impact 3: Impacts on threatened plants

Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localized populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival chances.

There are three Red List plant species that have a geographic distribution that includes the site and which have a high chance of occurring in the study area. This includes one species classified as Endangered (*Disa lugens* var. *lugens*), one as Vulnerable (*Bobartia macrocarpa*) and one as Near Threatened (*Pauridia minuta*). There is also one Vulnerable species and one Near Threatened species that have a medium probability of occurring on site. Most of the species that have a high probability of occurring on site would occur within natural fynbos vegetation.

Impact 4: Impacts on protected tree species

There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(I)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of section1 5(1) of the National Forests Act, 1998 "no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated".

A number of species have a geographic distribution that includes the study area appear on this list, including the following: *Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme* subsp. *inerme*. They all occur primarily in forest or woodland habitat or in drainage lines. Based on the assessment of available habitat, *Sideroxylon inerme* was considered to be highly likely to occur on site and the remaining species could occur on site. The tree, *Sideroxylon inerme*, was found as single individuals in rocky outcrops within fynbos within and adjacent to the site.

Impact 5: Impacts on indigenous natural vegetation (terrestrial)

Construction of infrastructure may lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of fynbos vegetation. Where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Consequences of the impact occurring may include:

1. negative change in conservation status of habitat (Driver et al. 2005);
2. increased vulnerability of remaining portions to future disturbance;
3. general loss of habitat for sensitive species;
4. loss in variation within sensitive habitats due to loss of portions of it;
5. general reduction in biodiversity;
6. increased fragmentation (depending on location of impact);
7. disturbance to processes maintaining biodiversity and ecosystem goods and services; and
8. loss of ecosystem goods and services.

It has been established that the most common vegetation on site is classified as Vulnerable. The site also falls within the Cape Floristic Region and affects areas classified as important corridors or habitats in the ECBCP.

Impact 6: Impacts on wetlands

Construction may lead to some direct or indirect loss of or damage to seasonal marsh wetlands or drainage lines or impacts that affect the catchment of these wetlands. This will lead to localised loss of wetland habitat and may lead to downstream impacts that affect a greater extent of wetlands or impact on wetland function. Where these habitats are already

stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to wetlands can have an impact on the functioning of those wetlands. Consequences may include:

1. increased loss of soil;
2. loss of or disturbance to indigenous wetland vegetation;
3. loss of sensitive wetland habitats;
4. loss or disturbance to individuals of rare, endangered, endemic and/or protected species that occur in wetlands;
5. fragmentation of sensitive habitats;
6. impairment of wetland function;
7. change in channel morphology in downstream wetlands, potentially leading to further loss of wetland vegetation; and
8. reduction in water quality in wetlands downstream of road.

The site contains a number of streams and drainage lines in which wetlands occur. More importantly, one of the major wetland systems on site constitutes part of the catchment for two estuaries on the coast down stream of the site (the Klipdrif and Krom River estuaries).

Impact 7: Establishment and spread of declared weeds and alien invader plants

Major factors contributing to invasion by alien invader plants includes high disturbance. Exotic species are often more prominent near infrastructural disturbances than further away (Gelbard & Belnap 2003, Watkins *et al*. 2003). Consequences of this may include:

1. loss of indigenous vegetation;
2. change in vegetation structure leading to change in various habitat characteristics;
3. change in plant species composition;
4. change in soil chemical properties;
5. loss of sensitive habitats;
6. loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
7. fragmentation of sensitive habitats;
8. change in flammability of vegetation, depending on alien species;
9. hydrological impacts due to increased transpiration and runoff; and
10. impairment of wetland function.

A checklist of species previously recorded in the grid in which the site is located indicates that the following species are likely to invade the site, given the right conditions: *Acacia cyclops*, *Acacia saligna*, *Acacia mearnsii*, *Datura stramonium*, *Hakea sericea* and *Pinus pinaster*. The potential therefore exists for extensive and diverse invasion of the site. The habitats most likely to be affected are watercourses and fynbos. The black wattle, *Acacia mearnsii*, and the pine tree, *Pinus pinaster*, were found on site, the former in large numbers in concentrated nodes.

ASSESSMENT OF IMPACTS

Impacts are assessed for each component of infrastructure for the proposed wind energy facility. There is therefore a seperate assessment for the turbines, substation, overhead power lines and the combination of underground cables between turbines and internal access roads.

Wind turbines

A total of 80 turbines have been proposed for the site, although the plans provided show only 77. The position of these in the study area is indicated in Figure 6.

Impact 1: Impacts on bats

There is one Near Threatened bat species that could occur site or in the surrounding areas, the Natal Long-fingered Bat. This is a cave-dwelling species that may form colonies of many hundreds of thousands of individuals. They roam up to 15 km from roosting sites to find prey at night. It has a wide distribution and the conservation status of the species will not be affected by construction on site or operation of the wind energy facility. Cumulative impacts due to the high number of wind energy facilities proposed for the region may, however, be of concern.

Extent: The impact will occur at the site of the proposed WEF, but will have an impact at a more regional level, since it affects entire populations of the affected species and may affect migration routes of the species.

Duration: The impact will occur during operation and will be long-term.

Magnitude: The impact is likely to result in a slight to moderate impact on population processes for the affected species, which is scored as low (will cause a slight impact on processes).

Probability: Due to the fact that any bats within 10-20 km of the site could be affected, as well as migrating bats, it is highly probable that the impact will occur.

Mitigation measures: A preconstruction survey for bats should be undertaken to determine whether bat species of concern occur on site or not and whether roosting habitats or known important maternity roosts occur within close proximity to the site. If this preconstruction survey finds that the presence of bats or roosting habitats of concern occur, then a monitoring programme must be implemented to document the effect on bats of the turbines. The detail of this monitoring programme must be informed by the outcomes of the preconstruction survey. If the turbines are found to have a significant negative impact on bats then further measures will need to be implemented to control the impact, for example, halting operation during low wind conditions. A study done recently showed a 73% drop in bat fatalities when wind farm operations were stopped during low wind conditions, when bats are most active (Arnett et al. 2009). Based on initial information, it is doubtful that these measures would be required.

Nature: Impacts on bat species of conservation concern		
	Without mitigation	**With mitigation**
Extent	regional (3)	local (3)
Duration	long-term (4)	long-term (4)
Magnitude	low (4)	minor (2)
Probability	Highly probable (4)	probable (3)
Significance	**medium (44)**	**low (27)**
Status (positive or negative)	negative	negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of	Yes	Yes

resources?		
Can impacts be mitigated?	To some extent	
Mitigation: (1) A preconstruction survey for bats should be undertaken to determine whether bat species of concern occur on site or not and whether roosting habitats or known important maternity roosts occur within close proximity to the site. (2) If this preconstruction survey finds that the presence of bats or roosting habitats of concern occur, then a monitoring programme should be implemented to document the effect of wind turbines on bat species of concern. (3) If the turbines are found to have a significant negative impact on bats then further measures will need to be implemented to control the impact, for example, consider stopping operation at key times when bats are vulnerable.		
Cumulative impacts: A number of wind energy facilities are proposed for this region. The cumulative impact of all these facilities would be significantly greater than one facility on its own.		
Residual Impacts: Will probably be some residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 2: Impacts on threatened terrestrial animal species

There are three mammal species of conservation concern that could potentially be affected by the proposed wind energy facility, i.e. the Brown Hyaena and the Fynbos Golden Mole, listed as Near Threatened, and Duthie's Golden Mole, listed as Vulnerable. In addition, there is one near threatened reptile species that has a distribution that includes the study area and which could occur on site, i.e. the Yellow-bellied House Snake. Impacts on the mole species are of the greatest concern.

Extent: The impact will be local.

Duration: The impact will occur during construction and will be long-term (if a population is affected, the duration will be until the population has recovered from any potential impact).

Magnitude: At a local scale, the impact is likely to result in population processes continuing, but in a modified way for the affected species, which is scored as moderate.

Probability: It is improbable that the impact will occur (it is not known whether the species of concern will be affected or not - if they occur within the footprint of the infrastructure it is probable that they will be affected).

Mitigation measures: Undertake a walk-through survey of areas with sandy soils once final infrastructure positions are known. If any populations are found in these areas or any habitats that are considered suitable for nearby populations, move infrastructure to avoid impact.

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	long-term (3)	short-term (1)
Magnitude	medium (6)	minor (2)
Probability	improbable (2)	Highly improbable (1)
Significance	**low (20)**	**low (4)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	yes	
Mitigation: (1) Undertake a walk-through survey of areas with sandy soils once final infrastructure positions are known. (2) If any populations are found in these areas or any habitats that are suitable for nearby		

populations, move infrastructure to avoid impact
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.
Residual Impacts: Unlikely to be residual impacts.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 3: Impacts on threatened plants

There are three Red List plant species that have a geographic distribution that includes the site and which have a high chance of occurring in the study area. This includes one species classified as Endangered (*Disa lugens* var. *lugens*), one as Vulnerable (*Bobartia macrocarpa*) and one as Near Threatened (*Pauridia minuta*). There is also one Vulnerable species and one Near Threatened species that have a medium probability of occurring on site. Most of the species that have a high probability of occurring on site would occur within natural fynbos vegetation.

Extent: The impact will occur at the site of the proposed turbines, but could potentially affect regional population processes if a significant population of these species is lost due to development of the site. The impact will therefore be evaluated at a regional scale.

Duration: The impact will be due primarily to construction impacts. Over the long-term there may be recruitment into habitats surrounding the impact zone, but habitat lost due to construction is a permanent loss.

Magnitude: The impact could potentially be of moderate magnitude and could result in population processes continuing, but in a modified way.

Probability: The probability of the impact occurring is the same for all of the plant species of concern.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible after construction is completed in the affected area. Prior to construction and once final infrastructure positions are known, the footprint of each turbine must be searched for populations of potentially affected plant species of concern. If any populations are found in these areas, move infrastructure to avoid impact. If it is not possible to relocate infrastructure, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

Nature: Impacts on threatened plants		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Highly improbable (1)
Significance	**Medium (42)**	**Low (10)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation: (1) Disturbance of indigenous vegetation must be kept to a minimum. (2) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. (3) Prior to construction and once final infrastructure positions are known, the footprint of each turbine must be searched for populations of potentially affected plant species of concern. (4) If any populations are found in these areas, move infrastructure to avoid impact (5) If it is not possible to relocate infrastructure, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.
Residual Impacts: Will probably be low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 4: Loss of individuals of protected tree species

A number of species have a geographic distribution that includes the study area appear on this list, including the following: *Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme* subsp. *inerme*. They all occur primarily in forest or woodland habitat or in drainage lines. Based on the assessment of available habitat, *Sideroxylon inerme* (white milkwood) is considered to be highly likely to occur on site and the remaining species could occur on site, although it is less likely. A small number of white milkwoods were found in the area.

Extent: The impact will occur at the site of the proposed WEF. It is scored as local. It may affect single individuals of protected species.

Duration: The impact will occur during construction, but (if natural habitat is affected) will be permanent.

Magnitude: Due to the wide distribution of the species, loss of individuals on site is unlikely to affect population processes throughout the range of this species. The impact is, however, being assessed at a local scale where impacts could result in processes continuing but in a modified way, which is scored as moderate.

Probability: Individuals of this species were found on site on rocky outcrops. It is considered probable that the impact will occur.

Mitigation measures: Undertake a walkthrough survey of the final infrastructure layout, in order to determine the exact number of individuals of protected trees that will be affected. Although not considered a mitigation measure, a permit would need to be obtained for any protected trees that are affected, so a legal obligation remains to determine the presence of protected trees irrespective of the significance of the impact.

Nature: Loss of individuals of protected trees		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	probable (3)	improbable (2)
Significance	**medium (36)**	**low (20)**
Status (positive or negative)	negative	negative

Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: (1) Once infrastructure positions have been finalised, the footprint of all infrastructure must be searched for individuals of protected trees. (2) If any trees are found within these areas, a permit will be required for their removal. (3)		
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that could potentially exacerbate this impact.		
Residual Impacts: None expected.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 5: Loss or fragmentation of indigenous natural vegetation

Twenty-nine of the 77 turbines are situated within natural vegetation on site. The natural vegetation on site is not in pristine condition. Vegetation structure and species composition have been affected by livestock grazing on site. However, fynbos has an intrinsically high biodiversity value.

Extent: The impact will occur at the site of the proposed turbines. The construction of the turbines potentially affects a small proportion of natural vegetation on site and is scored as local.

Duration: The impact will occur during construction, but will be permanent.

Magnitude: At a local scale, the impact is likely to result in a slight impact on processes, which is scored as low. The fragmentation effect may, however, cause ecological processes to continue but in a modified way, which is scored as moderate. This is due to the new nodes of disturbance created within undisturbed patches within the landscape.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures:

1. The final design must avoid natural areas as far as possible.
2. Unnecessary impacts on surrounding natural vegetation must be avoided.
3. The construction impacts must be contained to the footprint of the turbines and laydown areas.
4. Rehabilitate any disturbed areas immediately to stabilize landscapes.
5. Consider implementing biodiversity offsets, such as stewardship programmes, alien removal programmes or vegetation rehabilitation, to compensate for loss of indigenous natural vegetation.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	moderate (6)	Moderate to low (5)
Probability	definite (5)	definite (5)
Significance	**medium (60)**	**medium (55)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding the turbines. (2) Impacts should be contained to within the footprint of the turbines and laydown area. (3) Rehabilitate any disturbed areas immediately to stabilize landscapes. (4) Consider implementing biodiversity offsets, such as stewardship programmes, alien removal or vegetation rehabilitation, to compensate for loss of indigenous natural vegetation.		
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will definitely occur.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 6: Damage to wetlands/watercourses

Twenty of the turbines are currently positioned within mapped wetland areas or within 50 m of such features. These are turbine numbers 4, 6, 13, 25, 29, 30, 36, 39, 42, 44, 47, 49, 58, 59, 60, 62, 63, 64, 70 and 74.

Extent: The impact will occur at the site of the proposed turbines, but could have downstream impacts. The extent of the potential impact is therefore on the site and surroundings.

Duration: The impact will occur during construction, but will probably result in impacts that have a permanent effect.

Magnitude: In the long-term, impacts will result in processes continuing but in a modified way, which is scored as moderate.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures:

1. Move turbines a minimum of 50 m outside wetland areas. This is slightly more then the recommendation from the National Water Act.
2. For any turbines that are not moved, there is a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.
3. Stormwater and runoff water must be controlled for all infrastructure and managed to avoid siltation and surface hydrological impacts on wetlands.

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	moderate (6)	Minor (2)
Probability	Definite (5)	Improbable (2)
Significance	**high (65)**	**low (18)**
Status (positive or negative)	negative	negative
Reversibility	Reversible to some degree	

Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	To some degree	
Mitigation: (1) Relocate turbines 4, 6, 13, 25, 29, 30, 36, 39, 42, 44, 47, 49, 58, 59, 60, 62, 63, 64, 70 and 74 a minimum of 50 m away from wetland areas. (2) control stormwater and runoff water and inhibit erosion (1) obtain a permit from DWAF to impact on any wetland or water resource.		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on wetland habitats that will exacerbate this impact.		
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to a small degree.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 7: Establishment and spread of declared weeds and alien invader plants

Turbines will create new nodes of disturbance within an otherwise pristine landscape. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be greatly enhanced. Currently there are scattered individuals on site, except for *Acacia mearnsii*, which appears to have invaded some areas quite heavily in places on site and in the surroundings.

Extent: The impact will occur at the site of the proposed turbines, but could potentially spread extensively into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will occur for the duration of the operation of the facility and could create an invasive plant situation that lasts for more than a human life-span. This is scored as long-term.

Magnitude: Due to the current undisturbed nature of the potentially affected part of the site and the severe potential invasive problem that could develop in the absence of control, the impact is likely to be moderate (will result in processes continuing but in a modified way).

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	long-term (4)

Magnitude	moderate (6)	low (4)
Probability	Highly probable (4)	improbable (2)
Significance	**medium (48)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Substation

There are two alternative substation positions proposed on the site, one just north- of turbine 64 and one to the north of turbine 51. The site north of turbine 64 is within natural vegetation, whereas the site north of turbine 51 is mostly within an old land. The assessments below are for both substations, unless stated otherwise.

Impact 1: Impacts on bats

There is one Near Threatened bat species that could occur on site or in the surrounding areas, the Natal Long-fingered Bat. This is a cave-dwelling species that may form colonies of many hundreds of thousands of individuals. They roam up to 15 km from roosting sites to find prey at night. It has a wide distribution and the conservation status of the species will not be affected by construction on site or operation of the substation.

Extent: The impact will occur at the site of the proposed substation.

Duration: The impact will occur during operation and will be long-term.

Magnitude: The impact is likely to result in a minor impact on population processes for the affected species.

Probability: Due to the small size of the substation, it is improbable that the impact will occur.

Mitigation measures: None

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	long-term (4)	long-term (4)
Magnitude	minor (2)	minor (2)

Probability	improbable (2)	improbable (2)
Significance	**low (14)**	**low (14)**
Status (positive or negative)	negative	negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (1) None.		
Cumulative impacts: None.		
Residual Impacts: Unlikely to be residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 2: Impacts on threatened terrestrial animal species

There are three mammal species of conservation concern that could potentially be affected by the proposed wind energy facility, i.e. the Brown Hyaena and the Fynbos Golden Mole, listed as Near Threatened, and Duthie's Golden Mole, listed as Vulnerable. In addition, there is one near threatened reptile species that has a distribution that includes the study area and which could occur on site, i.e. the Yellow-bellied House Snake. Impacts on the mole species are of the greatest concern. The substations are not situated in an area with sandy soils. The substation north of turbine 51 is in a previously cultivated area and will not affect habitat for threatened terrestrial animal species. The assessment below is for the substation north of turbine 64.

Extent: The impact will be local.

Duration: The impact will occur during construction and will be permanent.

Magnitude: At a local scale, the impact is likely to result in a small impact on population processes for the affected species, if any.

Probability: The substation is not situated in an area with sandy soils and it is therefore considered highly improbable that the impact will occur.

Mitigation measures: None

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (3)	local (3)
Duration	permanent (5)	permanent (5)
Magnitude	small (1)	small (1)
Probability	Highly improbable (1)	Highly improbable (1)
Significance	**low (9)**	**low (9)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (3) None		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 3: Impacts on threatened plants

There are three Red List plant species that have a geographic distribution that includes the site and which have a high chance of occurring in the study area. This includes one species classified as Endangered (*Disa lugens* var. *lugens*), one as Vulnerable (*Bobartia macrocarpa*) and one as Near Threatened (*Pauridia minuta*). There is also one Vulnerable species and one Near Threatened species that have a medium probability of occurring on site. Most of the species that have a high probability of occurring on site would occur within natural fynbos vegetation. The substation north of turbine 51 is in a previously cultivated area and will not affect habitat for threatened plant species. The assessment below is for the substation north of turbine 64.

Extent: The impact will occur at the site of the proposed substation.

Duration: The impact will be due primarily to construction impacts. Over the long-term there may be recruitment into habitats surrounding the impact zone, but habitat lost due to construction is a permanent loss.

Magnitude: The magnitude of the impact depends on the species. The endangered species is unlikely to occur in the habitats at the proposed site of the substation. For the other two species, loss of some individuals (if they occur there) will not have a significant impact on population processes and is scored as low.

Probability: For the Endangered plant species (*Disa lugens*), it is unknown whether they occur within or near to the footprint of the substation. It is assessed as improbable that impacts will occur on populations of this species. For the Vulnerable plant species, there is a real risk of the species occurring there. It is assessed as probable that impacts will occur on populations of this species.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Prior to construction, the footprint of the substation must be searched for populations of potentially affected plant species of concern (primarily *Bobartia macrocarpa*).

Nature: Impacts on threatened plants (Disa lugens)		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	low (4)	minor (2)
Probability	probable (3)	Highly improbable (1)
Significance	**Medium (30)**	**Low (8)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) Prior to construction, undertake a targeted survey of the footprint of the substation to ensure that no populations of *Bobartia macrocarpa* occur there. If any populations are found, the substation should be		

repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.
Residual Impacts: Will probably be very low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 4: Loss of individuals of protected tree species

A number of species have a geographic distribution that includes the study area appear on this list, including the following: *Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme* subsp. *inerme*. They all occur primarily in forest or woodland habitat or in drainage lines. Based on the assessment of available habitat, *Sideroxylon inerme* (white milkwood) is considered to be highly likely to occur on site and the remaining species could occur on site, although it is less likely. A small number of white milkwoods were found in the area. The substation north of turbine 51 is in a previously cultivated area and will not affect individuals of protected tree species. The assessment below is for the substation north of turbine 64.

Extent: The impact will occur at the site of the proposed substation. It is scored as local. It may affect single individuals of protected species.

Duration: The impact will occur during construction, but (if natural habitat is affected) will be permanent.

Magnitude: Due to the wide distribution of the species, loss of individuals on site is unlikely to affect population processes throughout the range of this species. The impact is scored as minor.

Probability: Individuals of this species were found on site on rocky outcrops, but not where the substation is located. It is considered improbable that the impact will occur.

Mitigation measures: Undertake a walkthrough survey of the final infrastructure layout to ensure that no individuals of protected trees that will be affected. Although not considered a mitigation measure, a permit would need to be obtained for any protected trees that are affected, so a legal obligation remains to determine the presence of protected trees irrespective of the significance of the impact.

Nature: Loss of individuals of protected trees		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	minor (2)	small (1)
Probability	improbable (2)	Highly improbable (1)
Significance	**low (16)**	**low (7)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: (1) The footprint of all infrastructure must be searched for individuals of protected trees. (2) If any trees are found within these areas, a permit will be required for their removal.		

Cumulative impacts: Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that could potentially exacerbate this impact.
Residual Impacts: None expected.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 5: Loss or fragmentation of indigenous natural vegetation

The substation is situated within natural vegetation within the mountain region of the site. The substation north of turbine 51 is in a previously cultivated area and will not affect indigenous natural vegetation. The assessment below is for the substation north of turbine 64.

Extent: The impact will occur at the site of the proposed substation. The construction of the substation potentially affects a small proportion of natural vegetation on site and is scored as local.

Duration: The impact will occur during construction, but will be permanent.

Magnitude: At a local scale, the impact is likely to result in a slight impact on processes, which is scored as low.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures:

1. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the substation.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	low (4)	low to minor (3)
Probability	definite (5)	definite (5)
Significance	**medium (50)**	**medium (45)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: 1. Avoid unnecessary impacts on natural vegetation surrounding the substation.		
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will definitely occur.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 6: Damage to wetlands/watercourses

The substation is not close to any mapped wetland area. No impacts on wetlands are therefore expected to arise from construction or operation of the substation. This impact is therefore not evaluated further.

Impact 7: Establishment and spread of declared weeds and alien invader plants

The substation will create new node of disturbance within an area of natural vegetation. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be enhanced.

Extent: The impact will occur at the site of the proposed substation, but could potentially spread into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will occur for the duration of the operation of the facility and could create an invasive plant situation that lasts for more than a human life-span. This is scored as long-term.

Magnitude: The substation is situated within natural vegetation, but the entire site has been disturbed to a relatively extensive degree. However, severe invasion could occur in the absence of control. The impact is likely to be moderate (will result in processes continuing but in a modified way).

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	long-term (4)
Magnitude	moderate (6)	low (4)
Probability	Highly probable (4)	improbable (2)
Significance	**medium (48)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible		

(3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.
Residual Impacts: Will probably be very low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Overhead powerline

The overhead power line from the wind energy facility substation to the grid will be a 132kV line. There are three alternative alignments proposed. These are shown in Figure 7. The assessment below is identical for all three alignments, except where stated otherwise.

Impact 1: Impacts on bats

There is one Near Threatened bat species that could occur site or in the surrounding areas, the Natal Long-fingered Bat. This is a cave-dwelling species that may form colonies of many hundreds of thousands of individuals. They roam up to 15 km from roosting sites to find prey at night. It has a wide distribution and the conservation status of the species will not be affected by construction on site or operation of the power line.

Extent: The impact will occur at the site of the proposed power line and is scored as local.

Duration: The impact will occur during operation and will be long-term.

Magnitude: The impact is likely to result in a slight impact on population processes for the affected species, which is scored as minor (will not cause an impact on population processes).

Probability: Due to the fact that any bats within 10-20 km of the site could be affected, as well as migrating bats, it is probable that the these species will occur on site. However, there is a low likelihood of significant numbers of collisions with overhead powerlines. The probability is therefore scored as improbable.

Mitigation measures: None.

Nature: Impacts on individuals of threatened animal species – all alternatives		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	long-term (4)	long-term (4)
Magnitude	minor (2)	minor (2)
Probability	improbable (2)	improbable (2)
Significance	**low (14)**	**low (14)**
Status (positive or negative)	negative	negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (1) None.		
Cumulative impacts: A number of wind energy facilities are proposed for this region. The cumulative impact of powerlines from all these facilities could potentially be greater than for one powerline on its own.		

Residual Impacts: Will probably be some residual impacts.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 2: Impacts on threatened terrestrial animal species

There are three mammal species of conservation concern that could potentially be affected by the proposed wind energy facility, i.e. the Brown Hyaena and the Fynbos Golden Mole, listed as Near Threatened, and Duthie's Golden Mole, listed as Vulnerable. In addition, there is one near threatened reptile species that has a distribution that includes the study area and which could occur on site, i.e. the Yellow-bellied House Snake. Impacts on the mole species are of the greatest concern.

Extent: The impact will be local.

Duration: The impact will occur during construction and will be long-term (if a population is affected, the duration will be until the population has recovered from any potential impact).

Magnitude: At a local scale, the impact is likely to result in a moderate impact on population processes for the affected species (population processes may continue but in a modified way).

Probability: It is improbable that the impact will occur.

Mitigation measures: Undertake a walk-through survey of areas with sandy soils once final infrastructure positions are known. If any populations are found in these areas, move powerline tower structures slightly to avoid impact.

Nature: Impacts on individuals of threatened animal species – all alternatives		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	long-term (4)	medium-term (3)
Magnitude	moderate (6)	small (1)
Probability	improbable (2)	Highly improbable (1)
Significance	**low (22)**	**low (5)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (1) Undertake a walk-through survey of areas with sandy soils once final infrastructure positions are known. (2) If any populations are found in these areas, move tower structures slightly to avoid impact		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 3: Impacts on threatened plants

There are three Red List plant species that have a geographic distribution that includes the site and which have a high chance of occurring in the study area. This includes one species classified as Endangered (*Disa lugens* var. *lugens*), one as Vulnerable (*Bobartia macrocarpa*) and one as Near Threatened (*Pauridia minuta*). There is also one Vulnerable species and one Near Threatened species that have a medium probability of occurring on site. Most of the species that have a high probability of occurring on site would occur within natural fynbos

vegetation. There is also a known population of a Critically Endangered plant species that occurs in the vicinity of Happy Valley, which is where the western alternative power line route is proposed to be located.

Extent: The impact will occur at the site of the proposed powerline servitude and towers, but could potentially affect regional population processes if a significant population of these species is lost due to development of the site (especially for species listed as Endangered or Critically Endangered). The impact will therefore be evaluated at a regional scale.

Duration: The impact will be due primarily to construction impacts. Over the long-term there may be recruitment into habitats surrounding the impact zone, but habitat lost due to construction is a permanent loss.

Magnitude: The magnitude of the impact depends on the species. The known location of the Critically Endangered species (*Erica humansdorpensis*) is directly adjacent to a section of the powerline servitude for the western alternative and this species is very likely to be affected. The potential impact could therefore be very high (could result in complete destruction of patterns and permanent cessation of processes) if this population is destroyed. For the other species, the impact could potentially be of low magnitude and is unlikely to affect population processes.

Probability: The probability of the impact occurring is highly probable for the Critically Endangered species (*Erica humansdorpensis*) for the western alignment due to the fact that the powerline servitude is directly adjacent to the area where this species has been previously recorded. Any impacts on known habitat for this species would affect the chances of survival for this species. For the other plant species, it is unknown whether they occur within or near to the footprint of the powerline servitude. It is assessed as probable that impacts will occur on populations of other species.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Prior to construction, the footprint of the powerline servitude and the towers must be searched for populations of potentially affected plant species of concern. Suitable habitat for *Erica humansdorpensis* in the vicinity where it was previously recorded must be treated as a “no go” area. The western alternative alignment for the powerline should be omitted as an option, unless an laternative route past Happy Valley can be found.

Nature: Impacts on threatened plants (Erica humansdorpensis, CR) – western alternative only		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (10)	Small (0)
Probability	Highly probable (4)	Highly improbable (1)
Significance	**High (72)**	**Low (8)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum		

(2) rehabilitate disturbed areas as quickly as possible
(3) Prior to construction, undertake a targeted survey of the servitude of the power line and immediately adjacent areas to ensure that no populations of *Erica humansdorpensis* occur there.
(4) Suitable habitat for *Erica humansdorpensis* in the vicinity where it was previously recorded must be treated as a "no go" area. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.
(5) Consider the western alternative route as not viable unless an alternative route past Happy Valley can be found.

Cumulative impacts:
Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:
Will probably be low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Nature: Impacts on threatened plants (other species) – all alternatives

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Highly improbable (1)
Significance	**Low (36)**	**Low (12)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:
(1) keep disturbance of indigenous vegetation to a minimum
(2) rehabilitate disturbed areas as quickly as possible
(3) Prior to construction, during a suitable season, undertake a targeted survey of the footprint of the powerline towers to ensure that no populations of *other threatened species* occur there. If any populations are found, tower structures should be repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

Cumulative impacts:
Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.

Residual Impacts:
Will probably be very low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 4: Loss of individuals of protected tree species

A number of species have a geographic distribution that includes the study area appear on this list, including the following: *Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme* subsp. *inerme*. They all occur primarily in forest or woodland habitat or in drainage lines. Based on the assessment of available habitat, *Sideroxylon inerme* (white milkwood) is considered to be highly likely to

occur on site and the remaining species could occur on site, although it is less likely. It is almost certain that wooded valleys under the proposed power line routes will contain protected trees, especially *Sideroxylon inerme* (white milkwood). A small number of white milkwoods were found in the area.

Extent: The impact will occur at the site of the proposed power line. It is scored as local. It may affect single individuals of protected species.

Duration: The impact will occur during construction, but (if natural habitat is affected) will be permanent.

Magnitude: Due to the wide distribution of the species, loss of individuals on site is unlikely to affect population processes throughout the range of this species. The powerline tower structures a relatively small area of space. It is therefore unlikely that more than one individual at a time would be affected. The impact is, therefore, scored as low.

Probability: Individuals of this species were found on site on rocky outcrops. It is considered probable that the impact will occur.

Mitigation measures: Undertake a walkthrough survey of the final infrastructure layout, in order to determine the exact number of individuals of protected trees that will be affected. Where possible, tower structures should be shifted to avoid protected trees. Although not considered a mitigation measure, a permit would need to be obtained for any protected trees that are affected, so a legal obligation remains to determine the presence of protected trees irrespective of the significance of the impact. Biodiversity offsets should be considered if large numbers of individuals will be affected, but this depends on the final assessed magnitude of the impact. This offset could potentially take the form of planting seedlings in suitable locations to replace trees lost to the development.

Nature: Loss of individuals of protected trees		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	Low (4)	small (2)
Probability	probable (3)	improbable (2)
Significance	**medium (30)**	**low (16)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: (1) Once infrastructure positions have been finalised, the footprint of all infrastructure must be searched for individuals of protected trees. (2) If any trees are found within these areas, a permit will be required for their removal. (3) Additional biodiversity offsets or planting programmes may be required to replace lost trees, depending on the final assessed magnitude of the impact.		
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that could potentially exacerbate this impact.		
Residual Impacts: None expected.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 5: Loss or fragmentation of indigenous natural vegetation

Power lines are situated primarily in previously disturbed parts of the landscape, although approximately 20% of the power line routes (all options) still contains patches of natural

fynbos and/or thicket vegetation. It is not expected that power line towers will have a major effect on natural vegetation on site, due to the small footprint of each tower structure. Access roads may have a larger footprint, but these roads tend to be two-track vehicle tracks that, in general, do not have a major impact on natural vegetation.

Extent: The impact will occur at the site of the proposed power line tower structures and access roads. The construction of the tower structures and access roads potentially affects a small proportion of natural vegetation on site and is scored as local.

Duration: The impact will occur during construction, but will be long-term. Effective revegetation could reduce this to a medium-term impact.

Magnitude: At a local scale, the impact is likely to result in a slight impact on processes, which is scored as low.

Probability: According to the provided layout, it is highly likely that the impact will occur.

Mitigation measures:

1. Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the servitude of the powerline.
2. Disturbed areas must be rehabilitated as quickly as possible.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	low (4)	low to small (3)
Probability	Highly probable (4)	probable (3)
Significance	**medium (36)**	**low (24)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding the powerline. (2) Disturbed areas must be rehabilitated as quickly as possible.		
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will definitely occur.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 6: Damage to wetlands/watercourses

The western overhead power line route makes 21 wetland crossings, the widest of which is approximately 300 m. The central overhead power line route makes 16 wetland crossings, the widest of which is approximately 300 m. The eastern overhead power line route makes 15 wetland crossings, the widest of which is approximately 600 m.

Extent: The impact will occur at the site of the proposed powerline tower structures. The extent of the potential impact is therefore on the local scale.

Duration: The impact will occur during construction, but will probably result in impacts that have a long-term effect.

Magnitude: In the long-term, impacts will result in a slight impact on processes, which is scored as low, except for the one crossing of a wetland 600 m wide on the eastern alignment, which will probably have an impact of moderate magnitude.

Probability: According to the provided layout, it is probable that the impact will occur for the western and central alignments and highly probable for the eastern alignment (due to the one crossing of approximately 600 m).

Mitigation measures:

1. Tower structures must be placed outside wetland boundaries. It should be possible for all power lines to span any wetlands or watercourse.
2. There is a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.

Nature: Damage to wetland areas (central & western alignment)		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	low (4)	Small (2)
Probability	probable (3)	improbable (2)
Significance	**low (27)**	**low (14)**
Status (positive or negative)	negative	negative
Reversibility	Irreversible	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Place powerline tower structures outside wetland boundaries, OR (2) obtain a permit from DWA to impact on any wetland or water resource.		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on wetland habitats that will exacerbate this impact.		
Residual Impacts: Will be very small.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Nature: Damage to wetland areas (eastern alignment)		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	moderate (6)	Small (2)
Probability	Highly probable (4)	improbable (2)
Significance	**medium (44)**	**low (14)**

Status (positive or negative)	negative	negative
Reversibility	Irreversible	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Place powerline tower structures outside wetland boundaries, OR (2) obtain a permit from DWA to impact on any wetland or water resource. (3) Re-align the powerline to cross one wetland at a narrower point		
Cumulative impacts: Soil erosion, alien invasions, may lead to additional impacts on wetland habitats that will exacerbate this impact.		
Residual Impacts: Will be very small.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 7: Establishment and spread of declared weeds and alien invader plants

The proposed power lines are situated primarily in previously disturbed parts of the landscape. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be moderately enhanced.

Extent: The impact will occur at the site of the proposed powerline, but could potentially spread extensively into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: The impact will be of long-term duration.

Magnitude: Due to the current partially disturbed nature of the potentially affected part of the site and the severe potential invasive problem that could develop in the absence of control, the impact is likely to be moderate (will result in processes continuing but in a modified way).

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	long-term (4)
Magnitude	moderate (6)	low (4)
Probability	Highly probable (4)	improbable (2)

Significance	**medium (48)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Access roads and underground cables between turbines

Road infrastructure and the proposed location of underground cables associated with the wind turbines are shown in Figure 8. Underground cables between turbines will be situated beneath the internal access roads.

Impact 1: Impacts on bats

There is one Near Threatened bat species that could occur on site or in the surrounding areas, the Natal Long-fingered Bat. This is a cave-dwelling species that may form colonies of many hundreds of thousands of individuals. They roam up to 15 km from roosting sites to find prey at night. It has a wide distribution and the conservation status of the species will not be affected by construction on site or operation of internal access roads. Construction of the internal access roads will lead to a small loss of potential habitat.

Extent: The impact will occur at the site of the proposed internal access roads.

Duration: The impact will occur during construction and will be permanent.

Magnitude: The impact will be small (will have no impact on processes).

Probability: It is improbable that any impact will occur.

Mitigation measures: None.

Nature: Impacts on individuals of bat species of conservation concern		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	small (0)	small (0)
Probability	improbable (2)	improbable (2)
Significance	**low (12)**	**low (12)**
Status (positive or negative)	negative	negative
Reversibility	Reversible to some degree	Reversible to some degree

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (1) None.		
Cumulative impacts: No.		
Residual Impacts: Will not be residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 2: Impacts on threatened terrestrial animal species

There are three mammal species of conservation concern that could potentially be affected by the proposed wind energy facility, i.e. the Brown Hyaena and the Fynbos Golden Mole, listed as Near Threatened, and Duthie's Golden Mole, listed as Vulnerable. In addition, there is one near threatened reptile species that has a distribution that includes the study area and which could occur on site, i.e. the Yellow-bellied House Snake. Impacts on the mole species are of the greatest concern.

Extent: The impact will be local.

Duration: The impact will occur during construction and will be permanent.

Magnitude: At a local scale, the impact is likely to result in a moderate impact on population processes for the affected species.

Probability: It is possible that the impact will occur (it is not known whether the species of concern will be affected or not - if they occur it is probable that they will be affected). The extensive network of roads makes the likelihood greater that an impact will occur.

Mitigation measures: Impacts must be contained to within the footprint of the proposed internal access road. Surrounding vegetation must not be affected. Undertake a walk-through survey of areas with sandy soils once final infrastructure positions are known. If any populations are found in these areas, move road alignment to avoid impact.

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	medium-term (3)
Magnitude	moderate (6)	Small (2)
Probability	probable (3)	improbable (2)
Significance	**medium (33)**	**low (12)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (1) Impacts must be contained to within the footprint of the proposed internal access road. Surrounding vegetation must not be affected. (2) Undertake a walk-through survey of areas with sandy soils once final infrastructure positions are known. (3) If any populations are found in these areas, move tower structures slightly to avoid impact		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this impact.		
Residual Impacts: Unlikely to be residual impacts.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 3: Impacts on threatened plants

There are three Red List plant species that have a geographic distribution that includes the site and which have a high chance of occurring in the study area. This includes one species classified as Endangered (*Disa lugens* var. *lugens*), one as Vulnerable (*Bobartia macrocarpa*) and one as Near Threatened (*Pauridia minuta*). There is also one Vulnerable species and one Near Threatened species that have a medium probability of occurring on site. Most of the species that have a high probability of occurring on site would occur within natural fynbos vegetation.

Extent: The impact will occur at the site of the proposed access roads and underground cables. The impact will therefore be evaluated at a local scale.

Duration: The impact will permanent, because habitat lost due to construction is a permanent loss.

Magnitude: The magnitude of the impact could potentially be moderate (population processes may continue in a modified way).

Probability: The probability of the impact occurring is probable.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Prior to construction, the footprint of the internal access roads and underground cables must be searched for populations of potentially affected plant species of concern. If the road alignment cannot be adjusted to miss such populations then a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

Nature: Impacts on threatened plants (Erica humansdorpensis, CR)		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Small (2)
Probability	probable (3)	Very improbable (1)
Significance	**medium (36)**	**Low (8)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (1) Prior to construction, during a suitable season, undertake a targeted survey of the footprint of the internal access roads and underground cables to ensure that no populations of threatened species occur there. If any populations are found, the road alignment should be repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species..		

Cumulative impacts:
Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.
Residual Impacts:
Will probably be low if control measures are effectively applied

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 4: Loss of individuals of protected tree species

A number of species have a geographic distribution that includes the study area appear on this list, including the following: *Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme* subsp. *inerme*. They all occur primarily in forest or woodland habitat or in drainage lines. Based on the assessment of available habitat, *Sideroxylon inerme* (white milkwood) is considered to be highly likely to occur on site and the remaining species could occur on site, although it is less likely. A small number of white milkwoods were found in the area.

Extent: The impact will occur at the site of the proposed internal access roads and underground cables. It is scored as local. It may affect single individuals of protected species.

Duration: The impact will occur during construction, but (if natural habitat is affected) will be permanent.

Magnitude: Due to the wide distribution of the species, loss of individuals on site is unlikely to affect population processes throughout the range of this species. The impact is, however, being assessed at a local scale where impacts could result in processes continuing but in a modified way, which is scored as moderate.

Probability: Individuals of this species were found on site on rocky outcrops. It is considered probable that the impact will occur.

Mitigation measures: Undertake a walkthrough survey of the final infrastructure layout, in order to determine the exact number of individuals of protected trees that will be affected. Although not considered a mitigation measure, a permit would need to be obtained for any protected trees that are affected, so a legal obligation remains to determine the presence of protected trees irrespective of the significance of the impact. Although not considered likely that this would be necessary, biodiversity offsets should be considered if large numbers of individuals will be affected, but this depends on the final assessed magnitude of the impact. This could potentially take the form of planting seedlings in suitable locations to replace trees lost to the development.

Nature: Loss of individuals of protected trees		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	probable (3)	improbable (2)
Significance	**medium (36)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: (1) Once infrastructure positions have been finalised, the footprint of all infrastructure must be searched for individuals of protected trees.		

(2) If any trees are found within these areas, a permit will be required for their removal. (3) Additional biodiversity offsets or planting programmes may be required to replace lost trees, depending on the final assessed magnitude of the impact.
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands and increased frequency of veld fires may all lead to additional loss of habitat that could potentially exacerbate this impact.
Residual Impacts: None expected.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 5: Loss or fragmentation of indigenous natural vegetation

Most of the internal access roads and underground cable alignments are situated within natural vegetation on site. There are some existing tracks on site, but most the internal access roads will need to be built from new. The natural vegetation on site is not in pristine condition. Vegetation structure and species composition have been affected by livestock grazing on site. However, fynbos has an intrinsically high biodiversity value.

Extent: The impact will occur at the site of the proposed internal access roads. The construction of the roads potentially directly affects a moderate proportion of natural vegetation on site. The impact is therefore scored as local.

Duration: The impact will occur during construction, but will be permanent.

Magnitude: At a local scale, the impact will result in processes continuing but in a modified way, which is scored as moderate.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures: The following measures may reduce the impacts marginally:

1. Unnecessary impacts on surrounding natural vegetation must be avoided.
2. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.
3. Consider implementing biodiversity offsets, such as stewardship programmes, alien removal programmes or vegetation rehabilitation, to compensate for loss of indigenous natural vegetation.

Nature: Loss of habitat within indigenous natural vegetation types		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	permanent (5)	permanent (5)
Magnitude	moderate (6)	moderate (5)
Probability	definite (5)	definite (5)
Significance	**medium (60)**	**medium (55)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: (1) Avoid unnecessary impacts on natural vegetation surrounding the turbines. (2) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. (3) Consider implementing biodiversity offsets, such as stewardship programmes, alien removal		

or vegetation rehabilitation, to compensate for loss of indigenous natural vegetation.
Cumulative impacts: Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact.
Residual Impacts: Some loss of this vegetation type will definitely occur.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 6: Damage to wetlands/watercourses

Internal access roads and underground cable alignments cross wetlands in a number of places on site.

Extent: The impact will occur at the site of the proposed internal access roads, but could have downstream impacts. The extent of the potential impact is therefore local and surroundings.

Duration: The impact will occur during construction, but will probably result in impacts that have a permanent effect.

Magnitude: In the long-term, impacts will result in processes being altered to the extent that they continue, but in a modified way, which is scored as moderate.

Probability: According to the provided layout, it is definite that the impact will occur.

Mitigation measures: It has been proposed that some turbine positions should be altered to avoid impacts on wetlands. If this is undertaken, then some internal access roads will also shift. Other measures include the following:

1. Align internal access roads as close as possible to watersheds in the landscape.
2. Cross watercourses close to existing disturbances or use existing main roads to provide access to different parts of the site.
3. According to the layout provided, there are a number of places where multiple roads exist close to one another. Consolidate these internal access roads so that there is a smaller network of roads.
4. Intersections should not be placed within wetlands, as is currently the case with the provided layout.
5. There is a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.
6. Cross watercourses perpendicularly, where possible, to minimize the construction footprint.
7. Adequate culvert and/or bridge structures are required at crossings.
8. Construction must not cause the width of the watercourse to be narrowed.

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	moderate (6)	low (4)
Probability	Definite (5)	Highly probable (4)
Significance	**high (65)**	**medium (44)**
Status (positive or negative)	negative	negative
Reversibility	Irreversible	Reversible to some degree

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	

Mitigation:

(1) control stormwater and runoff water and inhibit erosion.
(2) Disturbed areas must be rehabilitated as soon as possible.
(3) Move some turbines to outside wetland areas. This will result in some internal access roads also shifting. The following measures must also be applied:
    a. Align internal access roads as close as possible to watersheds in the landscape.
    b. Cross watercourses close to existing disturbances or use existing main roads to provide access to different parts of the site.
    c. According to the layout provided, there are a number of places where multiple roads exist close to one another. Consolidate these internal access roads so that there is a smaller network of roads.
    d. Intersections should not be placed within wetlands, as is currently the case with the provided layout.
    e. obtain a permit from DWAF to impact on any wetland or water resource.
    f. Cross watercourses perpendicularly, where possible, to minimize the construction footprint.
    g. Adequate culvert and/or bridge structures are required at crossings.
    h. Construction must not cause the width of the watercourse to be narrowed.

Cumulative impacts:

Soil erosion, alien invasions, may lead to additional impacts on wetland habitats that will exacerbate this impact.

Residual Impacts:

Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Impact 7: Establishment and spread of declared weeds and alien invader plants

Internal access roads will create new areas of disturbance within natural areas in the landscape. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be enhanced to some degree.

Extent: The impact will occur at the site of the proposed internal access roads, but could potentially spread extensively into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. The impact will therefore be evaluated at a scale of site and surroundings.

Duration: This will be an issue of long-term duration.

Magnitude: Due to the current partially disturbed nature of the potentially affected part of the site and the potential invasive problem that could develop in the absence of control, the impact is likely to be moderate (will result in processes continuing but in a modified way).

Probability: It is assessed as probable that this impact will occur in the absence of control measures.

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately

controlled to avoid establishment of a soil seed bank. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	long-term (4)
Magnitude	moderate (6)	low (4)
Probability	Highly probable (4)	improbable (2)
Significance	**medium (48)**	**medium (20)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) keep disturbance of indigenous vegetation to a minimum (2) rehabilitate disturbed areas as quickly as possible (3) do not translocate soil stockpiles from areas with alien plants (4) control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (5) establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

Evaluation of power line route alternatives

The potential impacts of the three power line alternatives are very similar, except for two specific issues. The first of these is the presence of a population of a Critically Endangered plant species (*Erica humansdorpensis*) along the pathway of the western route (at Happy Valley). Unless this population can be avoided by finding an alternative route past this local site, this route would potentially result in an impact of high significance on a threatened plant species. This would make the western route unacceptable from the point of view of impacts on threatened plant species.

The second issue is a wetland along the eastern route that is more than 500 m across. It would not be possible to cross this wetland without placing a tower structure within the wetland, which could potentially result in an impact of medium significance. This issue is easily overcome by shifting the alignment slightly to cross the wetland at a narrower point.

Taking the issues above into consideration, the eastern and central routes are favoured above the western route.

Evaluation of substation alternatives

The more northern substation (north of turbine 51) is within a previously cultivated area. The potential impacts of this alternative are therefore of zero significance for threatened animals, threatened plants, protected trees and indigenous natural vegetation. This alternative is therefore favoured above the other alternative (to the north of turbine 64).

DISCUSSION AND CONCLUSIONS

There are three vegetation types that occurs on the site of the proposed wind energy facility, namely *Tsitsikamma Sandstone Fynbos* (classified as Vulnerable), *Eastern Coastal Shale Band Vegetation* (classified as Endangered) and *Southern Afrotemperate Forest* (classified as Least Threatened). It has been shown in this study that no forest vegetation occurs on site, only a large patch of alien trees that have been erroneously classified as indigenous forest. There are also three additional vegetation types that occur within the footprint of the proposed power line alternatives, namely Humansdorp Shale Renosterveld (classified as Endangered), Kouga Grassy Sandstone Fynbos (classified as Least Threatened) and Gamtoos Thicket (classified as Least Threatened). The vegetation on siteand along the power line alternatives has been classified at a Provincial level, through the Eastern Cape Biodiversity Conservation Plan (ECBCP), as having elevated conservation value. Some parts of the site are considered to have higher conservation value than others. The area is also within the Cape Floristic Region, one of the earth's 25 hotspots. It must be noted that these are broad-level assessments and do not take site-specific conditions into account, for example, the location of remaining areas of natural vegetation. It does, however, provide context in terms of the regional value of such remaining patches. Any natural vegetation patches occurring within a CBA area would therefore have elevated sensitivity, whereas transformed areas would not be sensitive.

Factors that may lead to parts of the study area having high ecological sensitivity are the potential presence of wetlands within the drainage lines on site, the potential presence of various plant and animal species of conservation concern, and protected trees.

Drainage lines (wetlands) represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches. Both functions are potentially critical to conservation of biological diversity as the landscape becomes increasingly fragmented into smaller, more isolated patches (Rosenberg *et al.*, 1997).

The drainage lines on site drain into two main systems that lead to the sea via the Klipdrif and Krom Rivers. The site constitutes part of the catchment for these rivers. The mouths of the rivers have an estuary, which is considered to be very sensitive and is shown as having high conservation value and sensitivity in the ECBCP. The potential impacts of activities on site on these river systems need to be carefully managed. It is especially important that the estuaries are not affected by activities on site.

Other than protected ecosystems and threatened plant and animal species, forests and wetlands are both protected under national legislation (National Forests Act and National Wetlands Act respectively). Any impacts on these areas would require a permit from the relevant National Department. There are eight tree species that are protected under the National Forests Act that have a geographic distribution that includes this area (*Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius*, *Prunus africana and Sideroxylon inerme* subsp. *inerme*) (Appendix 3), all of which have a moderate likelihood of occurring on site and one, *Sideroxylon inerme* (white milkwood), was recorded on site in small numbers. Any impacts on individuals of any of these species require a permit from the relevant National Department.

There are five plant species of conservation concern that could occur in available habitats in the study area. This includes one species classified as Endangered (*Disa lugens* var. *lugens*), one as Vulnerable (*Bobartia macrocarpa*) and one as Near Threatened (*Pauridia minuta*). There is also one Vulnerable species and one Near Threatened species that have a medium probability of occurring on site.

There are five animal species of conservation concern that may occur in habitats within the study area or that may be affected by the proposed WEF. This includes one species classified as Vulnerable (VU) and four as Near Threatened. Habitat requirements for these species are provided in the appendices to this report.

Parts of the site of the proposed wind energy facility and the areas across which the proposed power line alternatives cross are still in natural condition or considered to be natural vegetation; while majority of the site is transformed due to agriculture. Transformed / degraded areas on site are classified as having low sensitivity and conservation value (see Figure 5). Natural vegetation on site is not in pristine condition. The area is used for stock-farming and it is evident that grazing animals have had an impact on the vegetation, causing localised degradation and overall shifts in species composition. The natural vegetation is classified as having high sensitivity primarily due to the potential presence of threatened and protected species and due to the intrinsically high biodiversity value of fynbos, irrespective of condition.

A risk assessment was undertaken which identified seven main potential impacts on the ecological receiving environment. The identified potential negative impacts are the following:

1. Impacts on bats.
2. Impacts on threatened animals.
3. Impacts on threatened plants.
4. Impacts on protected tree species.
5. Impacts on indigenous natural vegetation.
6. Impacts on wetlands and estuary.
7. Establishment and spread of declared weeds and alien invader plants.

The significance of these impacts was assessed after collection of relevant field data. A summary of the significance of potential impacts is provided in Table 5.

The potential impacts on bats by turbines emerges as having medium significance (the score is 33, which is just slightly higher than “low”). Mitigation measures are proposed to reduce this potential impact, but some measures would not be required unless initial measures identified potential issues.

The potential impact on threatened animals by internal access roads and underground cables is of medium significance. This is due primarily to potential loss of habitat for two species of golden mole. This impact can be reduced by surveying the footprint of infrastructure for these species and make adjustments, if necessary, to localised layout.

The potential impacts by any infrastructure on threatened plants are rated as having medium significance. Species of concern could occur anywhere within remaining natural vegetation on site. This impact can be reduced by surveying the footprint of infrastructure for these species and make adjustments, if necessary, to localised layout. The impact is rated as having high significance for the western powerline alternative due to a single critically endangered species that is known to occur within the path of this alignment at one particular locality. Abandoning this alignment as an option or finding an alternative route to bypass this population would reduce the significance of this potential impact to “low”.

All infrastructure components could potentially affect individuals of the protected white milkwood tree, *Sideroxylon inerme*. The significance of this potential impact is rated as of “medium” significance. A walkthrough survey of final infrastructure positions will establish the potential magnitude of this issue. If significant numbers of individuals will be affected, which is

considered unlikely due to the extremely scattered distribution of this species within the types of habitat that occur on site, then biodiversity offsets could be considered.

Impacts on natural vegetation by all infrastructure components will have an impact of medium significance. For internal access roads the significance score borders on high. The primary reason for the significance score being as high as it is is due to the fact that the impact will definitely occur and will be permanent for all infrastructure components, except powerlines. A potential mitigation measure is to consider implementing biodiversity offsets to compensate for loss of indigenous natural vegetation, such as stewardship programmes, alien removal or vegetation rehabilitation.

Impacts on wetlands will be primarily due to turbines and internal access roads, both of which would have an impact of high significance. Modifying the position of turbines and internal access roads could reduce this impact significantly. Other measures could reduce impacts where wetlands cannot be avoided. However, this impact remains as one of the most problematic for the current development.

Alien trees could potentially invade any part of the site, if not controlled. The potential impact of alien invasion due to disturbance is of medium significance for all infrastructure components. Control measures, if applied, should effectively manage this issue.

Conclusion

Potential issues of concern on this site are impacts on wetlands, protected trees, threatened plants and animals, and indigenous fynbos vegetation. The turbines and the internal access roads could have an impact of high significance on wetlands and the western alternative power line could have an impact of high significance on a population of a critically endangered plant species. The turbines, the southern substation option and the internal access roads could have an impact of medium significance on indigenous natural vegetation. Mitigation measures cannot reduce the significance of this impact. All other impacts could potentially have a low significance, if mitigation measures are applied.

Areas with respect to high sensitivity are indicated in Figure 5 and 6. These are not necessarily “no-go” areas. On condition impacts on threatened and protected species are managed, it should be possible to develop within these areas. However, wetlands should be avoided as far as possible and impacts on wetlands kept to a minimum. The main measure for ensuring limited impacts on threatened and protected species is to undertake walk-through surveys of the proposed position of infrastructure, once a final layout has been established, in order to document the presence of species of concern and take preventative action, where necessary.

Recommendations

The following recommendations can lead to reduction or control of impacts:

- Turbines 4, 6, 13, 25, 29, 30, 36, 39, 42, 44, 47, 49, 58, 59, 60, 62, 63, 64, 70 and 74 should be moved in order to minimize impacts on wetlands. These turbines should be placed a minimum of 50 m outside the outer edge of wetlands.
- A comprehensive search for threatened and near-threatened plant and animal populations as well as individuals of protected trees must be undertaken within the footprint of the proposed infrastructure prior to construction. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants. If any plants or animals are found, localised modifications in the position of infrastructure must be made to avoid such populations and a suitable buffer zone around them.
- The western power line route passes a population of a critically endangered plant species near Happy Valley. On its own, impacts could probably be managed, but the cumulative impact of at least three proposed wind energy facilities all with a power line past this proposed point would make it difficult to manage impacts on this plant species. It is therefore recommended that this option not be considered further, unless a localised modification in this alignment can be accommodated. Either of the other two proposed powerline routes (central and eastern) are acceptable. There is a small issue with a single wetland on the eastern alignment, but this can be easily overcome with a small alignment modification. If so, the potential impacts are identical for both the eastern and central routes.
- The northern substation option (north of turbine 51) is within a previously cultivated area and will have few significant impacts compared to the other substation option. The northern substation option is therefore much preferred.

Table 5: Summary of the significance of impacts for different infrastructure components before and after mitigation.

Impact	Wind turbines		Substation			Overhead powerline			Underground cables & access roads	
	Without mitigation	With mitigation		Without mitigation	With mitigation		Without mitigation	With mitigation	Without mitigation	With mitigation
1. bats	medium (44)	low (27)		low (14)	low (14)		low (14)	low (14)	low (12)	low (12)
2. threatened animals	low (20)	low (4)	north of turbine 64	low (9)	low (9)		low (22)	low (5)	medium (33)	low (12)
			north of turbine 51	zero (0)	zero (0)					
3. threatened plants	medium (42)	low (10)	north of turbine 64	medium (30)	low (8)		medium (36)	low (12)	medium (36)	low (8)
			north of turbine 51	zero (0)	zero (0)	Western power line	high (72)	low (8)		
4. protected trees	medium (36)	low (20)	north of turbine 64	low (16)	low (7)		medium (30)	low (16)	medium (36)	low (20)
			north of turbine 51	zero (0)	zero (0)					
5. natural vegetation	medium (60)	medium (55)	north of turbine 64	medium (50)	medium (45)		medium (36)	low (24)	medium (60)	medium (55)
			north of turbine 51	zero (0)	zero (0)					
6. wetlands	high (65)	low (18)		zero (0)	zero (0)		low (27)	low (14)	high (65)	medium (44)
						Eastern power line	medium (44)			
7. alien plants	medium (48)	low (20)		medium (48)	low (20)		medium (48)	low (20)	medium (48)	low (20)

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30–60 = medium, >60 = high.

MANAGEMENT PLAN

Control measures are only proposed for those impacts where mitigation measures are proposed to reduce the significance of impacts, i.e. some impacts are of low significance and thus no mitigation measures are proposed or no mitigation measures are possible or required.

Impacts on bats

OBJECTIVE: Limit impacts on bats due to turbine blades	
Project component/s	Turbines
Potential Impact	Loss of individuals of the near threatened bat species, Natal Long-fingered Bat
Activity/risk source	Operation
Mitigation: Target/Objective	Target: limited mortalities within project control area Time period: operation

Mitigation: Action/control	Responsibility	Timeframe
(1) A preconstruction survey for bats should be undertaken to determine whether bat species of concern occur on site or not and whether roosting habitats or known important maternity roosts occur within close proximity to the site. (2) If this preconstruction survey finds that the presence of bats or roosting habitats of concern occur, then a monitoring programme should be implemented to document the effect of wind turbines on bat species of concern. (1) If the turbines are found to have a significant negative impact on bats then further measures will need to be implemented to control the impact, for example, halting operation during low wind conditions.	Management (environmental officer),	operation

Performance Indicator	Number of individuals killed by flying into overhead powerlineswithin project area
Monitoring	• Record bat mortalities and, as far as possible, the circumstances surrounding collisions. Standard protocols should be used when undertaking such surveys.

Impacts on threatened animals

OBJECTIVE: Limit impacts on threatened animals	
Project component/s	Any infrastructure or activity that will result in disturbance to habitat suitable for threatened animal species or to populations of threatened animal species
Potential Impact	Loss of habitat suitable for or populations of threatened animal species
Activity/risk source	Construction, environmental management
Mitigation: Target/Objective	Target: no significant impacts on identified suitable habitat or populations of threatened animal species within project control area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) Undertake a walk-through survey of areas with sandy soils once final infrastructure positions are known. (2) If any populations are found in these areas, move infrastructure to avoid impact	Construction team, management (environmental officer),	construction, operation

Performance Indicator	No loss of habitat suitable for or populations of threatened plant species
Monitoring	• Determine population numbers of affected species • After construction, evaluate loss of habitat suitable for or populations of threatened animal species and whether any individuals of affected species were lost to construction activities.

Impacts on threatened plants

OBJECTIVE: Limit impacts on threatened plants	
Project component/s	Any infrastructure or activity that will result in disturbance to habitat suitable for threatened plant species or to populations of threatened plant species
Potential Impact	Loss of habitat suitable for or populations of threatened plant species
Activity/risk source	Construction, environmental management
Mitigation: Target/Objective	Target: no significant impacts on identified suitable habitat or populations of threatened plant species within project control area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) avoid impacts on habitat identified as being suitable for threatened plant species or on populations of threatened plant species. (2) keep disturbance of indigenous vegetation to a minimum (3) rehabilitate disturbed areas as quickly as possible (4) Prior to construction, undertake a targeted survey of the footprint of the infrastructure to ensure that no populations of threatened plants occur there. If any populations are found, the infrastructure should be repositioned to avoid such populations. If not, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.	Construction team, management (environmental officer),	construction, operation

Performance Indicator	No loss of habitat suitable for or populations of threatened plant species
Monitoring	• Determine population numbers of affected species • After construction, evaluate loss of habitat suitable for or populations of threatened plant species and whether any individuals of affected species were lost to construction activities.

Impacts on protected trees

OBJECTIVE: Limit impacts on protected trees	
Project component/s	Any infrastructure that may affect protected trees
Potential Impact	Loss of single individuals or groups of protected trees
Activity/risk source	Construction
Mitigation: Target/Objective	Target: limit loss of individuals of protected trees Time period: construction

Mitigation: Action/control	Responsibility	Timeframe
(1) Where possible, position infrastructure so that individuals of protected trees are not affected. (2) Undertake a walkthrough survey of the site, once final infrastructure positions are known, in order to determine the exact number of individuals of each species that will be affected. (3) If it is not possible to avoid destroying trees, a permit is required from Dept. of Forestry for removal of trees or damage to trees. The permit requires the identity, number, size and condition of each tree that will be affected. (4) If large numbers of trees will be affected then additional biodiversity offsets or planting programmes will be required.	Environmental management team, management (environmental officer)	Construction

Performance Indicator	No loss of trees OR permit for affected trees
Monitoring	• None required

Impacts due to alien invasive plants

OBJECTIVE: Control alien invasive plants

Project component/s	Any infrastructure or activity that will result in disturbance to natural areas
Potential Impact	Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species
Activity/risk source	Construction, environmental management
Mitigation: Target/Objective	Target: no alien plants within project control area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) avoid creating conditions in which alien plants may become established: a. keep disturbance of indigenous vegetation to a minimum b. rehabilitate disturbed areas as quickly as possible c. do not import soil from areas with alien plants (2) establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act) (3) immediately control any alien plants that become established using registered control methods	Construction team, management (environmental officer),	construction, operation

Performance Indicator	For each alien species: number of plants and aerial cover of plants within project area and immediate surroundings
Monitoring	• Ongoing monitoring of area by environmental control officer during construction • Ongoing monitoring of area by environmental manager during operation • Annual audit of project area and immediate surroundings by qualified botanist. If no species are detected, then this can be stated. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants. The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. The environmental manager should be responsible for driving this process. Reporting frequency depends on legal compliance framework.

Impacts on indigenous natural vegetation

OBJECTIVE: Control loss of indigenous natural vegetation

Project component/s	Any infrastructure or activity that will result in disturbance to natural areas
Potential Impact	Loss of indigenous natural vegetation due to construction activities
Activity/risk source	Construction
Mitigation: Target/Objective	Target: minimal loss of natural vegetation Time period: construction

Mitigation: Action/control	Responsibility	Timeframe
(1) The construction impacts must be contained to the footprint of the infrastructure. (2) Unnecessary impacts on surrounding natural vegetation must be avoided. (3) Rehabilitate any disturbed areas immediately to stabilize landscapes. (4) Consider implementing biodiversity offsets, such as stewardship programmes, to compensate for loss of indigenous natural vegetation.	Construction team, management (environmental officer),	construction

Performance Indicator	No loss of natural vegetation within "no-go" areas. Loss of other natural vegetation only within designated footprint of infrastructure. No significant fragmentation of untransformed areas of natural vegetation.
Monitoring	• None

Impacts on wetlands

OBJECTIVE: Limit damage to wetlands & watercourses

Project component/s	Any infrastructure or activity that will result in disturbance to wetlands
Potential Impact	Damage to watercourses areas by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands). The focus should be on the functioning of the watercourse as a natural system
Activity/risk source	Construction, operation
Mitigation: Target/Objective	Target: no damage to watercourses within project area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) rehabilitate any disturbed areas as quickly as possible (2) control stormwater and runoff water and inhibit erosion (3) Powerline tower structures must be placed outside wetland boundaries (a minimum of 50 m away). (4) Appoint an independent environmental control officer during construction and an environmental manager during operation whose duty it will be to minimise impacts on surrounding sensitive habitats (5) For any new construction where direct impacts on wetlands are unavoidable, the following measures must also be applied: (6) cross watercourses perpendicularly to minimize disturbance footprints (7) obtain a permit from DWA to impact on any wetland or water resource. (8) Adequate culvert and/or bridge structures are required at crossings. (9) Infrastructure (including culverts and/or bridges) should not be placed within drainage line channels but should span them completely. (10) Construction must not cause the width of the watercourse to be narrowed. (11) Move some turbines to outside wetland areas. This will result in some internal access roads also shifting. (12) Align internal access roads as close as possible to watersheds in the landscape. (13) Cross watercourses close to existing disturbances or use existing main roads to provide access to different parts of the site. (14) According to the layout provided, there are a number of places where multiple roads exist close to one another. Consolidate these internal access roads so that there is a smaller network of roads. (15) Intersections should not be placed within wetlands, as is currently the case with the provided layout.	Construction team, management, environmental control officer	Construction, operation

Performance Indicator	No impacts on water quality, water quantity, wetland vegetation, natural status of watercourses

Monitoring	• Habitat loss in watercourses should be monitored before and after construction. • The presence and development of erosion features downstream of any construction through wetlands must be monitored. • The environmental manager should be responsible for driving this process. • Reporting frequency depends on legal compliance framework.

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APPENDICES:

Appendix 1: Plant species of conservation importance that have historically been recorded in the study area.

*IUCN (3.1) Categories:
VU = Vulnerable
EN = Endangered
CR = Critically Endangered
NT = Near Threatened

Table A: Threatened, Near Threatened and Declining plant species that have been previously recorded in the study area

Taxon	Habitat	Global IUCN (3.1) category*	Likelihood of occurrence
Osteospermum pterigoideum	Low sandstone slopes near Humansdorp.	EN	**LOW**, previously recorded 18 miles W of Humansdorp
Gasteria nitida var. armstrongii	Coastal renosterveld of lower Gamtoos valley. Old river bed.	CR	**LOW**, previously recorded 10 km W of Gamtoos River.
Dioscorea elephantipes	Rocky (quartzites and shales) east facing hillsides. In this region it is found in the Gamtoos River valley. In wooded kloof, Duineveld, Slang River. (1877)	Declining	**LOW**
Erica glumiflora	Stabilised sand dunes, often on calcrete (limestone) near coast. Wilderness to East London.	VU	**LOW**, previously recorded at Klipdrift, but in habitat that does not occur on site
Erica zeyheriana	Remnant lowland grassy fynbos on sand, Oyster Bay to Port Elizabeth. Previously recorded at: • Slang Rivier, duine veld • West of Oyster bay, north of Beacon 97. Deep acid soil. Hump in ploughed fields. Locally abundant. • W of Oyster Bay, NW of Beacon 97. Fixed dunes, deep acid sand, short fynbos on S side. • Dunes west of Oyster Bay. Klippe Drift 722. Low ridge SSW of farmstead. S 34°08.753' x E 24°34.035'.	VU	**LOW**, previously recorded adjacent to site in dune habitat that does not occur on site
Pauridia minuta	Langebaan to Riversdale. Previously recorded at: • N of Mpofu Dam & W of road from Humansdorp to the dam wall, situated close to the entrance gate to the dam property. DWAF property • 34°05'03.6" S; 24°41'31.0" E • 11 MI. W. OF HUMANSDORP	NT	**HIGH**, previously recorded just to north-east of site in habitat similar to that found on site
Bobartia macrocarpa	Flat open grassy patches, Kareedouw to Grahamstown. Previously recorded at	VU	**HIGH**, previously recorded on or just adjacent to central part of site.

Taxon	Habitat	Global IUCN (3.1) category*	Likelihood of occurrence
	Kruisfontein on road verge near Kromhout Farm near Oyster Bay. 34° 07'S, 24° 37'E. Cultivated land, grazed, disturbed. Grassy Fynbos. Remnant on road verge, very little habitat left.		
Rapanea gilliana	From Kliprivier Mouth, or Slangbaai, (just west of Cape St Francis) to Port Alfred. Coastal sand dunes. Duineveld scrub on coast. Slangbaai.	EN	**LOW**, previously recorded from Slangbaai in dune habitat that is not found on site.
Disa lugens var. lugens	Found in acidic as well as alkaline sands. Sea level to 1450 m. Found on coastal lowlands as well as mountain slopes and plateaus. Cape Peninsula to Cathcart, mountains and coast. Previously found near Oyster Bay in the vicinity of White Point.	EN	**HIGH**, previously recorded from Oyster Bay in dune habitat that is found in southern part of site. Could also occur in fynbos habitat, especially in wet areas
Satyrium princeps	Restricted coastal distribution between Wilderness in the southern Cape to Port Alfred in the Eastern Cape, seldom above altitudes of 150 m. Amongst bushes in open places on fixed dunes close to the shoreline. Previously found at Klipdrift. 34°7'52"S 24°33'27"E	VU	**LOW**, previously recorded 4 km west of site in dune habitat not found on site.
Pentaschistis longipes	Restricted to stabilized sand dunes around Humansdorp, usually near trees. Previously found at Brakkeduine near Oyster Bay. 34°10'16"S 24°39'46"E	VU	**LOW**, previously recorded from Oyster Bay in dune habitat that is not found on site.
Protea coronata	Cape Peninsula to Kouga centres of endemism. A variety of habitats, but especially Shale and Granite Fynbos in moist, south-facing situations. WITTE ELS BOSCH	NT	**MEDIUM**, suitable habitat may occur on site.
Selago rotundifolia	Knysna to Port Elizabeth, grassy fynbos flats and possibly also forest margins. Previously found near Klipdrift.	VU	**MEDIUM**, previously recorded from Klipdrift and suitable habitat may occur in southern part of site.

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria

Appendix 2: Vertebrate species of conservation concern with a geographical distribution that includes the current study area.
(included are species previously listed, but currently considered to be Least Concern)

MAMMALS

Common name	Order/ Family	Taxon	Habitat[1]	Status[2]	Likelihood of occurrence
ARTIODACTYLA / PERISSODACTYLA					
Oribi	Artiodactyla / Bovidae	*Ourebia ourebi*	Open grasslands with gentle topography at lower altitudes. Mosaic of tall and short grasses required to meet resting and feeding requirements.	LC, (was EN)	**MEDIUM**, previously recorded in grid to south-east
Blue duiker	Artiodactyla / Bovidae	*Philantomba monticola*	Coastal and afromontane forests as well as coastal thickets, selective forager in litter and fruits	LC, (was VU)	**MEDIUM**, previously recorded in grid to south
CARNIVORA					
Brown hyena	Carnivora / Hyaenidae	*Hyaena brunnea*	Savanna, urban areas, scavenger	NT	**MEDIUM**, previously recorded in neighbouring grid.
Honey badger	Carnivora / Mustelidae	*Mellivora capensis*	Wide variety of habitats. Probably only in natural habitats.	LC, (was NT)	**HIGH**, previously recorded in 3 neighbouring grids
African weasel	Carnivora / Mustelidae	*Poecilogale albinucha*	Moist grassland or woodland with more than 700 mm rainfall per year and where flourishing populations of small rodents occur. Grassland, scrub woodland. The distribution range of this animal covers the west coast of South Africa from Garies southward into the western Cape coastal belt, east and north-east Northern Cape, and all other provinces	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.
CHIROPTERA					
Lesser woolly bat	Chiroptera / Vespertilionidae	*Kerivoula lanosa*	Afromontane and riparian forest. Insectivore.	LC, (was NT)	**MEDIUM**, not previously recorded in grid, but overall geographical distribution includes this area.
Lesser long-fingered bat	Chiroptera / Vespertilionidae	*Miniopterus fraterculus*	Savanna, shrubland Afromontane and coastal forest. Cave-dwelling aerial insectivore	LC, (was NT)	**MEDIUM**, not previously recorded in grid, but overall geographical distribution includes this area.
Natal long-fingered bat	Chiroptera / Vespertilionidae	*Miniopterus natalensis*	Caves and sub-terranean habitats in Fynbos, savanna, woodland, succulent and Nama Karoo, grassland; cave-dwelling aerial insectivore.	NT	**HIGH**, previously recorded in neighbouring grid to north.
Temminck's hairy bat	Chiroptera / Vespertilionidae	*Myotis tricolor*	Caves in forests, shrubland, savanna, grassland, mountains; cave-dwelling aerial insectivore.	LC, (was NT)	**MEDIUM**, site within distribution range, but no

Common name	Order/ Family	Taxon	Habitat[1]	Status[2]	Likelihood of occurrence
					records in grid or neighbouring grids.
Cape horseshoe bat	Chiroptera / Rhinolophidae	*Rhinolophus capensis*	Caves and subterranean habitats; fynbos, shrubland and Nama-karoo in western and south-western parts of South Africa	LC, (was NT)	**MEDIUM**, not previously recorded in grid, but overall geographical distribution includes this site & recorded in grid to north.
Geoffroy's horseshoe bat	Chiroptera / Rhinolophidae	*Rhinolophus clivosus*	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	LC, (was NT)	**MEDIUM**, not previously recorded in grid, but overall geographical distribution includes this site & recorded in grid to north.
Swinny's horseshoe bat	Chiroptera / Rhinolophidae	*Rhinolophus swinnyi*	Caves, oldmines and subterranean habitats; roosts singly or in groups of up to five; in south of its range it appears to be associated with Afromontane forest.	LC, (was EN)	**LOW,** not previously recorded nearby, overall distribution does not include this area, but published data indicates that there is a possibility of it occurring in the southern Cape
INSECTIVORA					
Fynbos golden mole	Insectivora / Chrysochloridae	*Amblysomus corriae*	Lowland fynbos and Knysna forest, also in urban areas. Prefers sandy soils with deep litter layer.	NT	**HIGH**, at eastern edge of distribution, recorded in neighbouring grid, substrate properties on site suitable for this species.
Hottentott's Golden Mole	Insectivora / Chrysochloridae	*Amblysomus hottentotus*	Subterranean habitats; mainly Eastern Cape and KwaZulu-Natal; savanna, grassland and fynbos.	LC, (was DD)	**MEDIUM**, at western edge of distribution, previously recorded in neighbouring grid (to north-east)
Duthie's Golden Mole	Insectivora / Chrysochloridae	*Chlorotalpa duthieae*	Alluvial sand and sandy loam	VU (was LC)	**HIGH**, previously recorded in grid and neighbouring grid to west, substrate properties on site suitable for this species.
Reddish-grey musk shrew	Insectivora / Soricidae	*Crocidura cyanea*	Wide variety of habitats. Nocturnal, terrestrial.	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical

Common name	Order/ Family	Taxon	Habitat[1]	Status[2]	Likelihood of occurrence
					distribution includes this area.
Greater musk shrew	Insectivora / Soricidae	*Crocidura flavescens*	Wide variety of habitats, but favours some cover. Also urban areas, disturbed areas.	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.
Forest shrew	Insectivora / Soricidae	*Myosorex varius*	Wide variety of vegetation types, usually primary. Terrestrial habitats adjacent to wetlands; forest	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.
Least dwarf shrew	Insectivora / Soricidae	*Suncus infinitesimus*	Terrestrial, nocturnal	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.
Woodland mouse	Insectivora / Soricidae	*Grammomys dolichurus*	Riverine forest, thickets and woodland, terrestrial, arboreal	LC, (was DD)	**MEDIUM**, not previously recorded in grids, but overall geographical distribution includes this area.

[1]Distribution according to Friedmann & Daly 2004.
[2]Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 09 November 2010.

AMPHIBIANS

Common name	Species	Habitat	Status[2]	Likelihood of occurrence
Eastern Leopard Toad	*Amietophrynus pardalis*	Thornveld and open savanna in the Eastern Cape. Breed in open water and forage some distance from the water.	Declining	**LOW**, within distribution range, but habitats on site not suitable.

[2]Status according to du Preez & Carruthers 2009.

REPTILES

Common name	Species	Habitat[3]	Status	Likelihood of occurrence
Spotted rock snake	*Lampophis guttatus*	Rocky habitats under exfoliating rock flakes and in narrow rock crevices.	Rare[3]	**MEDIUM**, within overall distribution range and habitats may be available on site.
Yellowbellied house snake	*Lamprophis fuscus*	Old termitaria and under stones, underground. Found throughout more mesic parts of South Africa (Cape, east coast, Highveld).	NT[4]	**MEDIUM**, previously recorded in neighbouring grid, within overall distribution range and habitats may be available on site.

[3]Status according to Branch 1988.
[4]Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 09 November 2010.

Appendix 3: List of protected tree species (National Forests Act).

Acacia erioloba	*Acacia haematoxylon*
Adansonia digitata	*Afzelia quanzensis*
Balanites subsp. *maughamii*	*Barringtonia racemosa*
Boscia albitrunca	*Brachystegia spiciformis*
Breonadia salicina	*Bruguiera gymnhorrhiza*
Cassipourea swaziensis	*Catha edulis*
Ceriops tagal	*Cleistanthus schlectheri* var. *schlechteri*
Colubrina nicholsonii	*Combretum imberbe*
Curtisia dentata	*Elaedendron transvaalensis*
Erythrophysa transvaalensis	*Euclea pseudebenus*
Ficus trichopoda	*Leucadendron argenteum*
Lumnitzera racemosa var. *racemosa*	*Lydenburgia abottii*
Lydenburgia cassinoides	*Mimusops caffra*
Newtonia hildebrandtii var. *hildebrandtii*	*Ocotea bullata*
Ozoroa namaquensis	*Philenoptera violacea* (*Lonchocarpus capassa*)
Pittosporum viridiflorum	*Podocarpus elongatus*
Podocarpus falcatus	*Podocarpus henkelii*
Podocarpus latifolius	*Protea comptonii*
Protea curvata	*Prunus africana*
Pterocarpus angolensis	*Rhizophora mucronata*
Sclerocarya birrea subsp. *caffra*	*Securidaca longependunculata*
Sideroxylon inerme subsp. *inerme*	*Tephrosia pondoensis*
Warburgia salutaris	*Widdringtonia cedarbergensis*
Widdringtonia schwarzii	

Curtisia dentata, Ocotea bullata, Pittosporum viridiflorum, Podocarpus falcatus, Podocarpus latifolius and Sideroxylon inerme subsp. *inerme* have a geographical distribution that coincides with the study area.

Appendix 4: Checklist of plant species recorded during previous botanical surveys in the quarter degree in which the study area is located and the immediately adjacent grid to the south.

Acacia saligna (Labill.) H.L.Wendl.
Acalypha capensis (L.f.) Prain & Hutch.
Acroceras macrum Stapf
Acrolophia micrantha (Lindl.) Pfitzer
Adenocline pauciflora Turcz.
Agapanthus praecox Willd. ssp. praecox
Agathosma apiculata G.Mey.
Agathosma dielsiana Schltr. ex Dummer
Agathosma hirta (Lam.) Bartl. & H.L.Wendl.
Agathosma ovata (Thunb.) Pillans
Albuca cf. nelsonii N.E.Br.
Anchusa capensis Thunb.
Anthospermum spathulatum Spreng. ssp. uitenhagense Puff
Arctotheca populifolia (P.J.Bergius) Norl.
Arctotis discolor (Less.) Beauverd
Aristea bakeri Klatt
Aristea ensifolia J.Muir bis
Aspalathus biflora E.Mey. ssp. biflora
Aspalathus chortophila Eckl. & Zeyh.
Aspalathus ciliaris L.
Aspalathus collina Eckl. & Zeyh. ssp. collina
Aspalathus hispida Thunb. ssp. hispida
Aspalathus spinosa L. ssp. spinosa
Aspalathus subtingens Eckl. & Zeyh.
Astephanus zeyheri Turcz.
Avena fatua L.
Avena sativa L.
Babiana patersoniae L.Bolus
Berzelia abrotanoides (L.) Brongn.
Bobartia macrocarpa Strid
Bobartia orientalis J.B.Gillett ssp. orientalis
Bonatea speciosa (L.f.) Willd.
Brachypodium flexum Nees
Bromus catharticus Vahl
Brunsvigia striata (Jacq.) Aiton
Buddleja salviifolia (L.) Lam.
Bulbine frutescens (L.) Willd.
Cannomois scirpoides (Kunth) Mast.
Canthium spinosum (Klotzsch) Kuntze
Carissa macrocarpa (Eckl.) A.DC.
Cassine parvifolia Sond.
Cenia sp.
Centella asiatica (L.) Urb.
Ceratandra grandiflora Lindl.
Cestrum laevigatum Schltdl.
Chaenostoma cordatum (Thunb.) Benth.
Chaenostoma polyanthum Benth.
Chaetacanthus aff. setiger (Pers.) Lindl.
Chasmanthe aethiopica (L.) N.E.Br.

Chironia baccifera L.
Chironia melampyrifolia Lam.
Cliffortia burchellii Stapf
Cliffortia stricta Weim.
Clutia affinis Sond.
Coleonema pulchellum I.Williams
Conicosia pugioniformis (L.) N.E.Br. ssp. muiri (N.E.Br.) Ihlenf. & Gerbaulet
Conyza bonariensis (L.) Cronquist
Cotula coronopifolia L.
Crassula ericoides Haw. ssp. ericoides
Crassula expansa Dryand. ssp. filicaulis (Haw.) Toelken
Crassula spathulata Thunb.
Cussonia spicata Thunb.
Cyperus sphaerospermus Schrad.
Cyrtanthus clavatus (L'Hér.) R.A.Dyer
Cyrtanthus loddigesianus (Herb.) R.A.Dyer
Dasispermum suffruticosum (P.J.Bergius) B.L.Burtt
Dicliptera extenta S.Moore
Dierama pendulum (L.f.) Baker
Dioscorea elephantipes (L'Hér.) Engl.
Diosma hirsuta L.
Disa chrysostachya Sw.
Disa lugens Bolus var. lugens
Disa racemosa L.f.
Drosanthemum candens (Haw.) Schwantes
Ehrharta calycina Sm.
Ehrharta rupestris Nees ex Trin. ssp. tricostata (Stapf) Gibbs Russ.
Ehrharta villosa J.H.Schult. var. maxima Stapf
Elegia fistulosa Kunth
Elionurus muticus (Spreng.) Kunth
Epilobium hirsutum L.
Epischoenus quadrangularis (Boeck.) C.B.Clarke
Eragrostis capensis (Thunb.) Trin.
Eragrostis chloromelas Steud.
Erica canaliculata Andrews
Erica cerinthoides L. var. cerinthoides
Erica chloroloma Lindl.
Erica copiosa J.C.Wendl. var. copiosa
Erica curviflora L.
Erica curviflora L. var. curviflora
Erica deliciosa H.L.Wendl. ex Benth.
Erica diaphana Spreng.
Erica discolor Andrews var. discolor
Erica glandulosa Thunb. ssp. fourcadei (L.Bolus) E.G.H.Oliv. & I.M.Oliv.
Erica glandulosa Thunb. ssp. glandulosa
Erica glumiflora Klotzsch ex Benth.
Erica gracilis J.C.Wendl.
Erica leucopelta Tausch var. leucopelta
Erica maesta Bolus var. maesta
Erica pectinifolia Salisb.
Erica pectinifolia Salisb. var. pectinifolia
Erica peltata Andrews
Erica simulans Dulfer var. simulans

Erica sparrmanii L.f.
Erica speciosa Andrews
Erica tenella Andrews var. tenella
Erica thamnoides E.G.H.Oliv.
Erica uberiflora E.G.H.Oliv.
Erica zeyheriana (Klotzsch) E.G.H.Oliv.
Eriocephalus africanus L. var. paniculatus (Cass.) M.A.N.Müll.,P.P.J.Herman & Kolberg
Eriospermum dielsianum Poelln. ssp. molle P.L.Perry
Euclea racemosa Murray ssp. macrophylla (E.Mey. ex A.DC.) F.White
Felicia amelloides (L.) Voss
Felicia echinata (Thunb.) Nees
Ficinia deusta (P.J.Bergius) Levyns
Ficus sur Forssk.
Fuirena hirsuta (P.J.Bergius) P.L.Forbes
Gasteria acinacifolia (J.Jacq.) Haw.
Gasteria nitida (Salm-Dyck) Haw. var. armstrongii (Schönland) Van Jaarsv.
Gazania rigens (L.) Gaertn. var. uniflora (L.f.) Roessler
Geissorhiza heterostyla L.Bolus
Gerbera cordata (Thunb.) Less.
Gladiolus involutus D.Delaroche
Gladiolus permeabilis D.Delaroche ssp. permeabilis
Grewia occidentalis L. var. occidentalis
Gymnosporia nemorosa (Eckl. & Zeyh.) Szyszyl.
Harveya capensis Hook.
Harveya purpurea (L.f.) Harv. ex Hook. ssp. purpurea
Hebenstretia robusta E.Mey.
Helichrysum anomalum Less.
Helichrysum asperum (Thunb.) Hilliard & B.L.Burtt var. comosum (Sch.Bip.) Hilliard
Helichrysum aureum (Houtt.) Merr. var. monocephalum (DC.) Hilliard
Helichrysum crispum (L.) D.Don
Helichrysum cymosum (L.) D.Don ssp. cymosum
Helichrysum gymnocomum DC.
Helichrysum herbaceum (Andrews) Sweet
Helichrysum litorale Bolus
Helichrysum rosum (P.J.Bergius) Less. var. arcuatum Hilliard
Helichrysum spiralepis Hilliard & B.L.Burtt
Helichrysum teretifolium (L.) D.Don
Helichrysum tinctum (Thunb.) Hilliard & B.L.Burtt
Heliophila glauca Burch. ex DC.
Hermannia althaeoides Link
Hermannia sp.
Hermannia velutina DC.
Hibiscus diversifolius Jacq. ssp. diversifolius
Hibiscus trionum L.
Hypodiscus argenteus (Thunb.) Mast.
Indigofera denudata L.f.
Indigofera erecta Thunb.
Indigofera heterophylla Thunb.
Indigofera poliotes Eckl. & Zeyh.
Indigofera stricta L.f.
Indigofera verrucosa Eckl. & Zeyh.
Isolepis cf. striata (Nees) Kunth
Isolepis marginata (Thunb.) A.Dietr.

Isolepis natans (Thunb.) A.Dietr.
Jamesbrittenia microphylla (L.f.) Hilliard
Jamesbrittenia sp.
Juncus kraussii Hochst. ssp. kraussii
Juncus lomatophyllus Spreng.
Kedrostis nana (Lam.) Cogn. var. nana
Koeleria capensis (Steud.) Nees
Lampranthus sp.
Laportea peduncularis (Wedd.) Chew ssp. peduncularis
Laurembergia repens (L.) P.J.Bergius ssp. brachypoda (Welw. ex Hiern) Oberm.
Lauridia tetragona (L.f.) R.H.Archer
Laurophyllus capensis Thunb.
Lessertia kensitii L.Bolus
Leucospermum cuneiforme (Burm.f.) Rourke
Limonium scabrum (Thunb.) Kuntze var. corymbulosum (Boiss.) R.A.Dyer
Limonium scabrum (Thunb.) Kuntze var. scabrum
Linum aethiopicum Thunb.
Lolium multiflorum Lam.
Lolium temulentum L.
Manulea obovata Benth.
Merxmuellera cincta (Nees) Conert ssp. cincta
Metalasia muricata (L.) D.Don
Micranthus alopecuroides (L.) Rothm.
Monopsis acrodon E.Wimm.
Monopsis simplex (L.) E.Wimm.
Monsonia emarginata (L.f.) L'Hér.
Moraea tricuspidata (L.f.) G.J.Lewis
Morella cordifolia (L.) Killick
Morella quercifolia (L.) Killick
Muraltia alopecuroides (L.) DC.
Muraltia ericaefolia DC.
Muraltia squarrosa (L.f.) DC.
Nemesia sp.
Nerine peersii W.F.Barker
Nymphaea nouchali Burm.f. var. zanzibariensis (Casp.) Verdc.
Oedera capensis (L.) Druce
Olea capensis L. ssp. capensis
Olea exasperata Jacq.
Oplismenus hirtellus (L.) P.Beauv.
Oplismenus undulatifolius (Ard.) Roem. & Schult.
Ornithogalum tenuifolium F.Delaroche ssp. tenuifolium
Osteospermum pterigoideum Klatt
Osyris compressa (P.J.Bergius) A.DC.
Otholobium stachyerum (Eckl. & Zeyh.) C.H.Stirt.
Othonna quinquedentata Thunb.
Oxalis imbricata Eckl. & Zeyh. var. violacea R.Knuth
Panicum proliferum Lam.
Passerina montivaga C.L.Bredenkamp & A.E.van Wyk
Passerina rigida Wikstr.
Pauridia minuta (L.f.) T.Durand & Schinz
Pelargonium alchemilloides (L.) L'Hér.
Pelargonium candicans Spreng.
Pelargonium pulverulentum Colvill ex Sweet

Pelargonium radulifolium (Eckl. & Zeyh.) Steud.
Penaea cneorum Meerb. ssp. gigantea R.Dahlgren
Penaea cneorum Meerb. ssp. lanceolata R.Dahlgren
Pentaschistis ampla (Nees) McClean
Pentaschistis heptamera (Nees) Stapf
Pentaschistis longipes Stapf
Pentaschistis pallida (Thunb.) H.P.Linder
Persicaria attenuata (R.Br.) Soják ssp. africana K.L.Wilson
Phylica abietina Eckl. & Zeyh.
Phylica axillaris Lam. var. microphylla (Eckl. & Zeyh.) Pillans
Phylica gnidioides Eckl. & Zeyh.
Phylica litoralis (Eckl. & Zeyh.) D.Dietr.
Phyllopodium sp.
Phylohydrax carnosa (Hochst.) Puff
Pimpinella sp.
Plectranthus laxiflorus Benth.
Poa annua L.
Podalyria cuneifolia Vent.
Podocarpus falcatus (Thunb.) R.Br. ex Mirb.
Podocarpus latifolius (Thunb.) R.Br. ex Mirb.
Polygala ericaefolia DC.
Polygala myrtifolia L. var. myrtifolia
Polygala refracta DC.
Polygala wittebergensis Compton
Prismatocarpus campanuloides (L.f.) Sond. var. campanuloides
Protea coronata Lam.
Protea eximia (Salisb. ex Knight) Fourc.
Protea neriifolia R.Br.
Protea tenax (Salisb.) R.Br.
Psoralea affinis Eckl. & Zeyh.
Psoralea arborea Sims
Psoralea repens L.
Psydrax obovata (Eckl. & Zeyh.) Bridson ssp. obovata
Pterocelastrus tricuspidatus (Lam.) Walp.
Pterygodium alatum (Thunb.) Sw.
Pterygodium volucris (L.f.) Sw.
Ranunculus multifidus Forssk.
Rapanea gilliana (Sond.) Mez
Rhodocoma fruticosa (Thunb.) H.P.Linder
Rhoiacarpos capensis (Harv.) A.DC.
Roella spicata L.f. var. burchellii Adamson
Romulea dichotoma (Thunb.) Baker
Rubus fruticosus L.
Rumex acetosella L. ssp. angiocarpus (Murb.) Murb.
Rumex crispus L.
Rumex sagittatus Thunb.
Ruschia sp.
Salvia africana-lutea L.
Samolus porosus (L.f.) Thunb.
Satyrium acuminatum Lindl.
Satyrium parviflorum Sw.
Satyrium princeps Bolus
Scabiosa albanensis R.A.Dyer

Scabiosa columbaria L.
Scaevola plumieri (L.) Vahl
Schotia afra (L.) Thunb. var. afra
Searsia glauca (Thunb.) Moffett
Searsia laevigata (L.) F.A.Barkley var. laevigata forma laevigata
Searsia lucida (L.) F.A.Barkley forma scoparia (Eckl. & Zeyh.) Moffett
Secamone alpini Schult.
Selago canescens L.f.
Selago corymbosa L.
Selago rotundifolia L.f.
Senecio burchellii DC.
Senecio carnosus Thunb.
Senecio glastifolius L.f.
Senecio madagascariensis Poir.
Senecio oederiifolius DC.
Senna multiglandulosa (Jacq.) H.S.Irwin & Barneby
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. sphacelata
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. torta (Stapf) Clayton
Solanum aggerum Dunal
Spiloxene serrata (Thunb.) Garside var. serrata
Sporobolus africanus (Poir.) Robyns & Tournay
Stoebe plumosa (L.) Thunb.
Struthiola argentea Lehm.
Struthiola macowanii C.H.Wright
Sutherlandia frutescens (L.) R.Br.
Syncarpha milleflora (L.f.) B.Nord.
Tephrosia capensis (Jacq.) Pers.
Tetragonia decumbens Mill.
Tetraria sp.
Thamnochortus sp.
Themeda triandra Forssk.
Thesium penicillatum A.W.Hill
Thesium virgatum Lam.
Thinopyrum distichum (Thunb.) A.Löve
Trachyandra affinis Kunth
Tribolium hispidum (Thunb.) Desv.
Tribolium uniolae (L.f.) Renvoize
Trifolium burchellianum Ser. ssp. burchellianum
Tristachya leucothrix Trin. ex Nees
Tulbaghia violacea Harv. var. violacea
Ursinia scariosa (Aiton) Poir. ssp. scariosa
Vellereophyton vellereum (R.A.Dyer) Hilliard
Villarsia capensis (Houtt.) Merr.
Virgilia divaricata Adamson
Viscum capense L.f. ssp. hoolei Wiens
Wachendorfia thyrsiflora Burm.
Watsonia pillansii L.Bolus
Zantedeschia aethiopica (L.) Spreng.
Zehneria scabra (L.f.) Sond. ssp. scabra